GOVERNMENT OF INDIA

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SEED REVIEW TEAM

REPORT

1968

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I.J. NAIDU,
Leader, Seed Review Team.

New Delhi,
Dated 14th June, 1968.

Dear Shri Sivaraman,

I have great pleasure in enclosing the Report of the Seed Review Team constituted by the Government of India,—*vide* Resolution No. 20/11/67-Seeds (Dev.), dated the 10th October, 1967.

We have arranged the material in four parts. Part I gives in brief the present situation of Seed Industry as observed by the Team in the foreign countries visited, in our country and its conclusions and recommendations. This is to facilitate those who cannot spare much time to go into the detailed discussions of the various issues facing seed development presented in Part II. Part III is a descriptive account of the Seed Industry in all its aspects in the various countries visited by the Team which should be of interest to many. Part IV contains the two questionnaires, issued by the Team, statistical data and other information. The Reprot is unanimous.

Our recommendations have been made in the light of the potentialities and the conditions of agriculture obtaining in India. In particular, we have kept in view the immediate objectives of rapid increase in agricultural production under the new strategy of hybrids and High Yielding Varieties Programme through the instrumentality among others of a healthy and vigorous seed industry. We do hope that these recommendations when implemented will serve the above objectives.

Yours sincerely,

(I.J. NAIDU).

Shri B. SIVARAMAN, I.C.S.,
Secretary to the Government of India,
Ministry of Food, Agriculture and
Community Development,
Department of Agriculture,
Krishi Bhavan,
New Delhi-1.

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VOL. I
PART I

CHAPTER —1

INTRODUCTORY

1.1. Although the importance of good seed has been recognized in India from early times, some of the most significant steps were taken only in late 1950. Programmes for systematic seed multiplication and distribution were initiated during the Third Plan. In 1957 a co-ordinated maize improvement programme was started by the Government of India in collaboration with the Rockefeller Foundation. This was followed by the co-ordinated sorghum and millets improvement programmes, the release of hybrids of maize, sorghum and bajra adapted to India, the establishment of the National Seeds Corporation, the starting of seed testing programmes and the passing of the Seeds Act by the Parliament in December, 1966. A chronological development in brief of the important stages of seed development in India is given in Table I.

1.2. A number of committees have been set up in the last decade both at the Centre and in the States for reviewing the arrangements for seed production and distribution and suggest further measures for improvement. Amongst the all-India Committees which have done valuable work and brought together much useful information, mention may be made of the reports of the Project Evaluation Organization and the Committee on Plan Projects of the Planning Commission. A number of useful suggestions have also been made in the two Indo-American Reports on Agricultural Research, Education and Extension and in the Nalagarh Committee Report on Agricultural Administration.

1.3. The progress in seed development work in India has, however, been very rapid and many new developments had occurred in the last three years which called for a fresh appraisal. Basically of course, these developments form part of the changes occurring in Indian Agriculture today under the impact of the new strategy initiated on a massive scale in Kharif, 1966. Increasing availability of water, double and multiple cropping, preference for short duration varieties, increasing applications of fertilizers and plant protection measures and eager readiness to adopt new and better ways are the obvious signs of this change. Words like hybrids, Mexican Wheat, Taichung Paddy, IR-8, ADT-27, etc., which have become houshold words of many farmers, indicate the new awareness in seeds. At the same time, in the same period many basic facilities have been built up. Seed Testing Laboratories have been established in all the States. The National Seeds Corporation was established as an All-India Foundation Seed Production Organization for hybrids. The Corporation has organized certification services for hybrids in different States. New seed processing techniques have also been adopted widely. A new seed industry is emerging —the Seeds Act was passed by the Parliament in December, 1966. The rapid change in seeds has also brought up a number of problems and called for a fresh appraisal of the situation and recommend short-term as well as long-term measures. With a view to undertake such a review, the Government of India constituted the Seed Review Team with the following persons:—

(1) Shri I. J. Naidu, Joint Secretary to the Government of India, Department of Agriculture,—*Leader*.

(2) Dr. R.L. Paliwal, U.P. Agricultural University, Pantnagar, U.P.

(3) Dr. H.R. Arakeri, Director of Agriculture, Mysore

(4) Dr. Anand Sawant, Officer on Special Duty, Hybrid Seed Research and Production, Government of Maharashtra.

(5) Shri B.R. Barwale, Chief Executive and Managing Partner, Maharashtra Hybrid Seeds Corporation, Jalna (Maharashtra).

(6) Shri C.G. Ramanathan, Special Director, E.I.D. Parry Ltd., Madras.

(7) Shri J. Veeraraghavan, National Seeds Corporation Ltd., New Delhi,—*Member-Secretary*.

1.4. The terms of reference of the Team were as follows :—

(1) to assess the existing arrangements for production of breeder, nucleus, foundation and certified seeds of varieties, hybrids, composites, etc.

(2) to evaluate the progress made in scientific processing, packing and storage of seeds and the indigenous manufacture of processing and storage equipment for achieving self-sufficiency.

(3) to consider steps required for effective quality control of seeds and specific arrangements for seed certification and enforcement of Seed Law.

(4) to review the development of marketing of seeds at all stages.

(5) to assess the credit facilities required for seed production, seed processing and seed marketing.

(6) to identify the role of various agencies of the Union and State Governments, co-operatives and private agencies in seed production, processing and distribution.

(7) to consider the steps to be taken for making available superior varieties to the farmers immediately after their approval and release.

(8) to consider and recommend steps so that the seed production takes place in all the States and there is no lopsided development of the industry.

(9) to recommend measures necessary for the rapid development of healthy seed industry.

1.5. The Team commenced its work in October, 1967, with a survey of the present status of seed development, technology and legislation in various agriculturally advanced countries. In an intensive tour of seed farms, seed processing plants and seed organizations, the Team visited six countries in 45 days and met with a number of scientists, seedsmen and officials. The Team held discussions with officials of all the countries, and with private seedsmen and their organizations and also met the representatives of four international organizations engaged in seeds. The Team had the opportunity to participate and observe the working of the Annual Conference of International Crop Improvement Association which met at Biloxi in October.

1.6. Though the Team did not visit Canada, it had the benefit of discussions with the Canadian representatives who were present at the International Crop Improvement Conference referred to above. Mr. Douglas of the Rockefeller Foundation who has considerable experience of seed work in India and in the U.S.A. assisted in the discussions in various countries. In the U.S.A. the Team had also the benefit of the expert assistance of Prof. A.S. Carter who acted as the guide of the Team in its tour in the U.S.A.

1.7. The Team also undertook a study of the actual conditions in India by visits to seed farms, seed processing plants and seed organizations. The Team held extensive discussions with State Government officials, representatives of Co-operative Societies, National Seeds Corporation, scientists, I.C.A.R. and other interested groups and organizations.

1.8. In its assessment of the Indian situation the Team was assisted by a Group of seeds Experts from the U.S.A. provided by the Rockefeller Foundation grant. This group consisted of :—

Prof. A. S. Carter, former Director, Seed Certification, Purdue University, Lafayetter—Indiana.

Dr. Walter Scott, Extension Agronomist, University of Illinois and President, International Crop Improvement Association.

Mr. Clare Porter, General Manager, N.C. Hybrids, Lincoln, Nebraska.

Mr. Johnson E. Douglas.—Seed production Specialist, Rockefeller Foundation.

These Experts undertook an intensive study of conditions in India covering a large area in a short time met with various groups and held discussions. The Group made valuable observations and recommendations and the Team wishes to place on record its deep appreciation of the good work done by this Group in a short time. The Team would also like to thank the Rockefeller Foundation for making available the services of these Experts.

1.9. The Team issued two questionnaires both of which are reproduced in the Appendices I & II. The first questionnaire was issued before the Team undertook the study of conditions abroad and was used as a world-wide questionnaire guiding the discussions in the foreign countries. The second questionnaire was issued on return to India after taking into account the information gathered and observations made abroad and was designed to elicit information on the Indian situation. The latter questionnaire was circulated in English as well as in Hindi and received a wide response. The replies received in response to the questionnaire, were further supplemented by personal discussions in many cases. In addition to the replies of questionnaire, many State Governments also furnished self-contained notes on seed programmes, 1.10. We have been able to gather a fund of information both in our itinerary abroad and tours within the country and during the many discussions which we had with private seed industry and associations, State Government officials, agricultural universities, farmers and others interested in seed development. Realising that it would be desirable not to make this Report needlessly voluminous, we have thought it fit to arrange the Report in 4 parts. Part I is meant for the busy reader who would like to obtain all the information and recommendations in a brief summary. A fuller discussion of the various issues involved is presented subjectwise in Part II which includes all the more important issues facing the seed industry today such as registration and release of varieties, production of breeders, foundation and certified seeds, seed processing, marketing including export and storage, quality control through seed testing, seed certification and Seed Law enforcement and the role to be played by the different agencies involved such as Central and State Governments, agricultural universities, co-operatives and private agencies. We have also included separate chapters on provision of finance and credit and on training. In order to enable a student of seed industry to get a full information in respect of seed industry in all its aspects in the various countries visited, we have also endeavoured to present a fuller and complete account of the seed industry in the various countries visited by the Team under Part III so that this can serve as a source book in some detail about the various aspects of seed industry in a convenient and handy form. In Part IV we have included the various appendices, the two questionnaires issued by the Team and the list of institutions visited and individuals the Team met at various places. We do hope that the information provided in the Report in the above manner will suit the needs of the busy administrator, the scientists and students of seed industry, private entrepreneur, the farmers and all others concerned and enable them to look into only those areas in which they are interested without the need to go into the entire Report to gather information in which they are interested. The Team hopes that the information provided in the report would be of use to all concerned with seed development pogrammes.

TABLE I

Chronological Summary

1957	A Co-ordinated Maize Improvement Programme was started in collaboration with the Rocke feller Foundation.
1960	The Co-ordinated Sorghum and Millets Improvement Programme was started.
1961	The first four maize hybrids adapted to India were released. The Rockefeller Foundation supplied equipment which arrived at the Indian Agricultural Research Institute to establish the first fully equipped seed testing laboratory in India.
	Final plans were made for establishing a seed testing laboratory in every State with U.S.A.I.D. support.
	The 1st Seed Testing Training Course was held at I.A.R.I.
1962	The Government of India formed a Committee to draft the Seeds Act.
	The first three seed processing plants in India were established with the Rockefeller Foundation's equipment.
	The 2nd Seed Testing Training Course and the 1st Seed Development Training Course were conducted.
	Two Seed Testing Laboratories were in operation.
1963	The N.S.C. was established with the primary objective of producing foundation seeds of the newly released maize hybrids.
	Two more maize hybrids were released.
	The 3rd Seed Testing Training Course and the 2nd Seed Development Training course were conducted.
	Two more seed testing laboratories were established.
	Dwarf, high-yielding wheat varieties from Mexico were first tested.

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1964	.. The India Crop Improvement and Certified Seed Producers' Association was formed.
	.. The 4th Seed Testing Training Course and the first Comprehensive Seed Production, Processing and Certification Course were conducted.
	.. Four Seed Testing Laboratories were established.
	.. The first sorghum hybrid and another maize hybrid were released.
	.. Certified seed production area of hybrids reached 902 hectares.
	.. The first seed processing plant established with the equipment supplied by U.S.A.I.D. on lease to seed producers through the N.S.C.
1965	.. A bulk import of 250 tons of dwarf wheat seed was arranged from Mexico.
	.. The National Tonnage Club of Farmers was formed.
	.. The 5th Seed Testing Training Course and two comprehensive Seed Production Processing and Certification Courses were offered.
	.. Five Seed Testing Laboratories were established.
	.. The first pearl millet hybrid and the second sorghum hybrid were released.
	.. Multiplication was started of the first dwarf, highly fertilizer-responsive rice variety.
1966	.. The Seeds Bill was passed by the Lok Sabha.
	.. High-Yielding Varieties Programme adopted to achieve rapid increase in yields.
	.. The 6th Seed Testing Training Course, the 1st Vegetable Seed Improvement and two Comprehensive Seed Production, Processing and Certification Courses were conducted.
	.. Equipment was distributed for the last four Seed Testing Laboratories under the U.S.A.I.D. programme.
	.. 18,000 tons of dwarf wheat seed imported from Mexico and distributed for Rabi sowings to various States.
1967	.. The Ministry of Food and Agriculture developed a draft of rules to be used with the Seeds Act.
	.. Private, N.S.C. and State Government seed processing plants totalled 82.
	.. The 7th Seed Testing Training Course, the 2nd Vegetable Seed Improvement Course and four Seed Production, Processing and Certification Courses were conducted.
	.. New dwarf wheat varieties were released from the All-India Co-ordinated Wheat Improvement Programme.
	.. A new maize hybrid and six maize composites were released.
1968	.. Two Comprehensive Seed Production, Processing and Certification Courses have been conducted.

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CHAPTER—2

SEED AND ITS IMPORTANCE

2.1. The history of agricultural progress from the early days of man has been the history of new crops and varieties brought under cultivation. In the early days this was achieved through the cultivation of indigenous but useful plants and those taken through introductions even from foreign countries. Selection of superior types from cultivated plants constituted the next stage of progress. Over the course of years many useful selections were made and there was gradual but steady progress in crop improvement. It was, however, with the advent of the sciences of Genetics and Plant Breeding, that new vistas were opened and it became possible for man to manipulate the genetic composition of varieties to his advantage. Through the well-known techniques of selection, hybridization and polyploidisation the scientist makes available new and better varieties, i.e., varieties which serve the farmer better than the existing varieties.

2.2. Yet, to the farmer all this scientific research would be of little value unless he gets seeds which are true to type genetically and possess other desired qualities, such as vigour, germination, freedom from mixtures, weeds, etc. When the farmer does not get seed possessing genetic and physical qualities up to desired standards the yields he obtains from his crop may not be as expected. If purity of a seed lot is 70 per cent and viability is 70 per cent, the pure live seed of the lot that the farmer gets is only 49 per cent (70 × 70/100) and it is not to be wondered that very often the results achieved at research institutes are not duplicated on the fields. Only seed with assured purity—genetic and physical—can be expected to respond to fertilizers and other inputs in the expected manner. The farmer and the country lose heavily if the anticipated response is not obtained. Only seed with good germination and vigour can give a good stand of crop. Otherwise there would be inadequate plant population and low yields. A mere increasing of the seed rate may compensate for poor germination but it cannot ensure vigorous growth or uniformity in plant population. The other aspect of quality, namely, freedom from admixtures and weeds is of even greater importance. Some of the weeds would be noxious and if so they might contaminate a whole area and prove a threat to crop production. Others might not be noxious, but would compete with the crops and lower the yields. Admixtures might be of other varieties, undesirable plants and inert material. Some of these might convey harmful pathogens and cause diseases. It is, therefore, of crucial importance from the point of view of agricultural production that the farmer gets pure and healthy seed of adapted varieties.

2.3. There is another aspect of the importance of good seed. Amongst the inputs used by the farmer seed is the cheapest input and it forms only a small part of his cultivation expenses. Yet, on this vital input depends the return he obtains from other costly inputs, from his land and labour. All his efforts and investment would be unremunerative if he does not get good seeds of adapted varieties—farmers are aware of this and would rarely hesitate to spend more to obtain quality seeds.

2.4. In the context of the conditions prevailing in our country today, quality seed offers great potentialities. It is the cheapest method of increasing agricultural production, requiring little or no foreign exchange but only organization and effort on our part. It also stands for new technology, new cropping patterns and new methods of obtaining higher yields per acre. The release of high-yielding paddy and Mexican wheat varieties, hybrids of jowar, maize and bajra and many other crops have opened new vistas in agriculture. The Fourth Five-Year Plan postulates a 5 per cent or 6 per cent annual growth in agricultural production—a task in the achievement of which improved seeds have a vital part to play. A good programme can lead to agricultural abundance and the realization of the goals enshrined in our Constitution.

2.5. Interest in seed improvement programmes dates back to the Royal Commission's Report of 1926. The Royal Commission observed, *inter alia*. that (a) many of the improved varieties included in the programme of multiplication and distribution had not been thoroughly tested under conditions obtaining on farmer's fields ; (b) facilities required for increasing supply of breeder seed were inadequate ; (c) attention bestowed upon maintenance of purity was poor.

Among the suggestions made by the Commission were :—

(a) A separate set of staff within the State Departments of Agriculture should attend to seed testing and seed distribution work ;

(b) Seed distribution in normal situations be a self-supporting activity ;

(c) Co-operative agencies should be utilized by the State Departments of Agriculture for seed distribution ; and

(d) Seed merchants of approved integrity and enterprise should be encouraged.

2.6. The setting up of various research institutes by the Government of India and Provincial Administrations and the promotion and co-ordination of research by the Indian Council of Agricultural Research and Commodity Committee resulted in the evolution of many new superior varieties not only of cash crops like sugarcane, cotton and jute but also of foodgrain crops like paddy and wheat. Seed multiplication and distribution work, however, did not keep pace with the research and the Famine Enquiry Commission of 1945 and the Grow-More-Food Enquiry Committee of 1952 found that much remained to be done in this field.

2.7. The latter Committee made a number of detailed suggestions. As a result, a few farms were established for seed multiplication. With the advent of the First Five-Year Plan, the use of improved seeds was made the basis of calculation for additional production of foodgrains. The seed distribution programme initiated under the Grow-More-Food Campaign was included as part of the First Five-Year Plan and a sum of Rs 2 crores was spent on the establishment of seed farms.

2.8. The Second Five-Year Plan estimated that 10 per cent of the original target of additional production of foodgrains would be realized by the use of improved seeds. To hasten the progress of replacement of local crops by improved varieties, it was decided to decentralise multiplication and distribution of improved seeds under the Community Development Blocks. A policy was laid down that every National Extension Service Block should be served by a seed farm and a seed store. It was decided to establish 4,328 seed multiplication farms of 25 acres each at the rate of one farm for each Community Development Block. These farms were for the specific purpose of increasing breeder seed into foundation seed and were to be under the direct supervision of the Departments of Agriculture. The foundation seeds were to be further multiplied on the lands of selected farmers with the object of increasing the seed supply. The registered seed thus produced was to be made available to all the farmers in each village through institutional channels like Co-operatives and Panchayats.

2.9. Unlike the First Plan which provided finance mostly on seed distribution work, the Second Plan made available large portion of the Plan Outlay for the establishment of seed farms. Rs. 16.76 crores or 93 per cent of the total outlay of Rs. 18.1 crores on all seed schemes was earmaked for the establishment of farms. The actual expenditure on seed farms established during the Second Plan period was Rs. 14.61 crores.

2.10. At the end of the Second Plan, 1,893 units with a total area of 82,355 acres are reported to have been established. Most of these farms were established in the later part of the plan. The Plan Outline had originally envisaged additional foodgrains production of 10 million tonnes. By the last year of the Second Plan 55 million acres of foodgrains were estimated to have been covered with improved seeds and the additional yields from this were estimated to be 1.23 million tonnes. About 20 per cent of the area under foodgrains was covered. The coverages under improved seeds for cash crops were much higher, (Cotton 77 per cent, Sugarcane 97 per cent and Jute 53 per cent).

2.11. The progress of the seed programme was reviewed periodically by experts of the Ministry of Food and Agriculture (Department of Agriculture), the Programme Evaluation Organization and the Seed Multiplication Team of the Committee on Plan Projects. These reports showed that the programmes suffered from many defects in implementation. They also brought out several andicaps and several disabilities encountered by the States. Among the shortcomings, the following were mentioned :—

> Nucleus or breeder seed was not received annually or in adequate quantities. The seed programme was limited to a few, more important cereals and millets. Too many varieties of the same crop were multiplied on the same farm. The programme of production of foundation seed of particular varieties was not properly related to the needs of the block in relation to actual requirements of different crops. Foundation seed was always not fully utilized. There was no check on timely and proper use of foundation seed supplied to registered growers. Inspection of fields of registered growers and roguing of crops were not done timely. Disposal of registered seeds was often left to the growers themselves. A large production of registered seed was not used for sowing. Inadequate financing prevented procurement of registered seed in full. Seed processing was defective. Complaints about poor germination and impurities of seeds were common. No systematic cropping schemes or records specific to seed production on different stages were maintained. Co-operative Societies were not interested in handling the distribution of improved seeds as they did not find it a profitable undertaking. Storage facilities were inadequate and defective. Seed testing was done either perfunctorily or was not done. The overwhelming proportion of improved seeds used by the farmers was derived either from their own stocks or obtained from other farmers.

2.12. These deficiencies were sought to be remedied in the Third Plan. The setting up of seed testing laboratories and the strengthening of the State seed farms was given high priority in the Third Plan Programme. The target for foundation seed farms was fixed at 4,789 units with 1,19,225 acres. Actually 2,349 farms with an area of 1,04,604 acres are reported to have been established. Of these 2,100 farms were reported to have been provided with seed stores. 6,200 additional seed stores each with 100 ton capacity were proposed to be set up during the Fourth Plan at distribution points.

2.13. The year 1961 which was celebrated as World Seed Year by the Food and Agricultural Organization of the United Nations was an important year for India also. It was in this year that India became a member of the International Seed Testing Association. The rapid developments of events in the field of seed from that year onwards may be seen in the statement of Chronological Development in brief given at Table—1. During the subsequent period the Indian Council of Agricultural Research, the Indian Agricultural Research Institute and other Central Institutes and the State Governments co-operated in the co-ordinated crop improvement programmes. Out of these intensive efforts which brought together large collections of germplasm from all parts of the world, new hybrids of maize were released in 1961, of sorghum in 1964 and of pearl millet in 1965.

2.14. The need for a new organization to multiply inbred and single cross seeds of hybrids and to assist the development of a seed industry was recognized in the early sixties. This foresight resulted in the formation of the National Seeds Corporation, a Government of India Undertaking, incorporated under the Companies Act.

2.15. Through the stimulus of new and strikingly superior varieties and the hybrids and the formation of the National Seeds Corporation, the programme has expanded rapidly. Over 7,000 growers are now participating in a massive seed production effort. New seed companies have been formed and co-operatives are taking increased interests in seeds. Seed processing equipment is being used. Over 80 seed processing plants have been established by State Governments, National Seeds Corporation and private organizations. Certified hybrid seed production has increased from 1.8 hectares in 1960-61 to 29,000 hectares in 1967-68.

2.16. The National Seeds Corporation currently serves as the seed certification agency for the hybrids. However, under the Seeds Act passed by the Indian Parliament in December, 1966, the States may establish their own seed certifying agencies.

2.17. The Seeds Act was passed by the Parliament in 1966 and it includes two main sections :—

(a) Truthful labelling of seeds sold commercially and minimum limits of germination and purity ;

(b) Provisions upon which to build a comprehensive seed certification programme.

Rules are yet to be formally notified and implementation of the Act is now to be taken up.

2.18. The Government of India decided in the early 1960's to establish seed testing laboratories on the basis of one per State and to train personnel to operate them. The United States Agency for International Development (U.S.A.I.D.) agreed to assist in this programme. The Rockefeller Foundation assisted in equipping the Central Seed Testing Laboratory in New Delhi. Several States have now constructed new seed testing laboratory buildings. Many of these laboratories have a common lay-out and most of them provide space for testing and storing from 20,000 to 40,000 seed samples per year. The arrival and installation of equipment was phased over a four-year period from 1962 to 1966. Today seventeen main laboratories are established.

2.19. The total number of samples tested increased from 6,000 in 1962 to 65,000 in 1967. This development is parallel to the increase in certified hybrid seed production of maize, sorghum and pearl millet (bajra) as illustrated in the following table :—

Testing and Production compared

Year	Number of samples tested	Hectares of certified hybrid seed production
1962-63	6,000	465
1963-64	10,000	653
1964-65	12,000	902
1965-66	30,000	7,000
1966-67	40,000	17,000
1967-68	65,000	29,000

2.20. This spectacular development can be expected to continue as the area under certified seed production of both hybrids and other improved varieties increases.

2.21. In addition, the implementation of the truthful labelling under the Seeds Act also will contribute thousands of additional samples to be tested.

2.22. The present seed testing laboratories potentially have a total capacity of 4,50,000 samples and can meet the need for several years without major enlargements to the present buildings except in two or three States where good facilities still are lacking.

2.23. To sum up, in the 30 years ending 1960, there was much progress in research and in release of new varieties, but little progress in multiplication of good seeds thereof. During the Grow-More-Food Campaign and the First Five-Year Plan, seeds were purchased from the market and distributed and such seeds were hardly different from grains except that they were of improved variety.

2.24. The Second Five-Year Plan envisaged a bold bid to make each National Extension Block self-sufficient in seeds, but in effect the seed programme was transmitted into a farm development programme.

2.25. The Third Five-Year Plan was mostly pre-occupied with remedying the defects in seed programmes of the Second Plan. However, a beginning was made in seed certification on a voluntary basis and seed testing laboratories were established. Towards the close of the Third Plan, promising new varieties were introduced and hybrids of jowar and bajra were released.

2.26. All phases of seed improvement have made rapid strides in India since the early 1960's. The introduction of exotic types and the co-ordinated plant breeding programmes have resulted in an entirely new source of germplasm available to agricultural scientists and farmers. The introduction of a comprehensive seed certification programme on hybrid seed production has helped to ensure good quality seed to farmers. The development of seed testing laboratories has been an essential phase of the total programme. Without the laboratories the programme could not have been successful ; but without an intensive seed production programme, the laboratories would have little use. The training of personnel has been an essential ingredient in the progress made to date. The adoption of the strategy of high-yielding varieties from 1966-67 for a rapid advance in agricultural productivity has given a new impetus to the seed programme in the country.

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CHAPTER—3

SEED INDUSTRY IN THE COUNTRIES VISITED

3.1. In Part III we have dealt in some detail on various aspects of seed industry in Sweden, the Netherlands, the United Kingdom, the United States of America, Japan and the Philippines. In this Chapter we would like to draw attention, very briefly, to some of the more important features of seed industry in these countries.

RESEARCH IN PLANT BREEDING

3.2. In the United States alone, over Rs. 500 lakhs are reported to be spent annually by private seed companies on research and development. The number of firms doing research in the field of vegetables was reported to be 15 while it was 24 for maize and 20 for sorghum. The research programmes of private companies were particularly strong in the field of hybrids, cotton and vegetables. Some of the leading companies have also been attempting to evolve hybrid wheats. These research efforts on the part of the private companies are in addition to the research in plant breeding and seed development by the Federal and State Government Research Institutions, agricultural universities and private foundations.

3.3. There is a clear trend in the United States towards a division of work between research in the private sector and in public institutions. Public research is tending towards basic research and on research techniques while private efforts are concentrated on applied research.

3.4. In Sweden, the research effort is shared equally between the Swedish Seed Association which is essentially a government financed agency and a number of private firms. Research in sugar beets is left entirely to the sugar industry. In the Netherlands, there are two research stations of the government but these concern themselves mostly with basic research. Applied research is left to the private companies.

3.5. In the U.K., most of the research comes from public funds, though, in the field of vegetable seeds, considerable research effort is shared by private companies. In Japan, research on major crops like paddy and potatoes, is in the hands of government research stations. Private firms are active in the field of vegetables. In the Philippines, where paddy is the main crop, the research work is shared between the Philippines College of Agriculture and the International Rice Reseach Institute, Manila.

3.6. As regards techniques of plant breeding, first generation hybrids are being widely used in cross-pollinated cereals and vegetables. Hybrid maize and hybrid sorghum dominate the scene in the respective crops in the United States. Composites are not considered equal to hybrids. Composites are used only for providing the basic material for selection of better hybrids. The general view was, that, at a given level of composites it should always be possible to produce superior hybrids. The advantages that composites have for some countries were, however, recognized.

3.7. The Team was considerably impressed with the arrangements made in Japan for a genetic storage house. This is the backbone of the cereal breeding system in Japan. It is felt by Japanese research workers that to ensure that the gene constitution of specific genetic stocks remains the same from year to year (which is vital for successful research), it is necessary that genetic stocks should not be raised annually (as this will cause variations due to environment) but should be stored on a long-term basis in cold storage and supplied to research workers as they need it. For this purpose, the National Institute of Agricultural Sciences, Hiratsuka, maintains a cold storage facility for genetic stocks. The Team visited this storage house which has an overall space of 335 sq. metres. The seeds are kept under two types of conditions—(a) long-term storage room (63 sq. metres with temperature of –1° C and 30 per cent relative humidity) and (b) extremely longterm storage (34 sq. metres with –10°C and 30 per cent relative humidity). The seed storage house is equipped with seed cleaning rooms, operation room for drying of seeds, heat and vacuum sealing facilities and facilities for testing the germination of seeds. In addition to facilitating research, the seed storage house also serves as a reserve source of supply of seed for multiplication of foundation seed.

Production of Breeder Seed

3.8. All the countries visited had special arrangements made for production of breeder and foundation seeds. Great stress is laid on the availability of foundation seed in adequate quantities and of assured quality. In Sweden, where the Swedish Seed Association (A Government financed body) has a major share of the total research effort, the right of multiplying foundation seeds of varieties evolved from this public effort has been given to the General Swedish Company in which shares are mostly held by farmers. The General Swedish Company pays a certain amount of royalty to the Swedish Seed Association in return for the sole rights of multiplication enjoyed by it. The contract between the Company and the Association is regulated by an agreement which is approved and controlled by the Swedish Government. In the Netherlands, the private companies which evolve new varieties are responsible for arranging the supply of foundation seed. Under the new law of 1967, each breeder is responsible for ensuring adequate availability of seeds of varieties evolved by him. If he fails to make such arrangements, the breeder can be compelled to permit others to multiply the foundation seed. In the United Kingdom till recently, the National Institute of Agricultural Botany (which was the agency for testing of new varieties) had a Division for maintenance and supply of foundation seeds. Recently the work of foundation seed multiplication has been transferred to the National Seed Development Organization Ltd., which was formed as a limited company in 1967. The function of this organization is to develop in the United Kingdom and abroad plant varieties resulting from research carried out by Government Departments or other public bodies or any other research in the United Kingdom. The organization is financed initially by a treasury loan and the profits of the organization will go to the exchequer. Income will be derived both from the sale of seed and royalties in respect of plant varieties for which plant breeders have been granted licence under the Plant Varieties and Seeds Act, 1964. For the present, the actual work of seed multiplication will continue to be done by the National Institute of Agricultural Botany on behalf of the National Seed Development Organization.

3.9. The arrangements in the United States vary widely from State to State. At the Federal level the U.S. Department of Agriculture has an organization for foundation seeds called the National Foundation Seed Agency. This is part of the Agricultural Research Service of the U.S. Department of Agriculture. The programme of this organization is presently limited to forage and legumes. The programme is worked out in consultation with the State Certifying Agencies and Seed Associations and is meant to ensure an adequate supply of foundation seed for production of certified seed praticularly of new varieties developed by public institutions. Breeder seed stocks are provided by the respective research stations and multiplication is undertaken with the assistance of the Seed Certification Agencies, seed growers, and the seed trade, under Government contracts. Funds required for the programme are provided by the Commodity Credit Corporation under the U.S. Department of Agriculture.

3.10. A National Advisory Committee guides and formulates the general policy for foundation seed production and its distribution. The Committee consists of 8 members and 8 alternates with equal representation for the seed trade (American Seed Trade Association), Agricultural Experiment Station, and State Seed Certification Agencies. The quantity of seed to be grown, the area where they are to be grown, the prices to be paid to growers and the prices at which the seeds are to be sold, are all decided by this Advisory Committee and their recommendations are usually accepted. The members hold office for two years and are generally succeeded by their alternates.

3.11. The bulk of the foundation seeds of forage and legumes is produced in California on account of the fertile loamy soils and the bright sunny weather obtaining there. Production is organised by contracting with good growers who are selected on the basis of their past record. Contract growers arrange with seed firms for the processing of their crops. The State Certifying Agencies arrange for the certification before the stocks are allotted to the States for distribution. Storage facilities available with the trade are also made use of by the National Organization.

3.12. The distribution of the foundation seed is done on the advice of the National Advisory Committee. In fact, before planning the production, the States are consulted as to their requirements, which the organization endeavours to meet. As a safeguard against shortages arising due to drought, floods, etc., the organization carries a large reserve stock of anywhere between 1 to 3 times the estimated demand. This policy also ensures a stable price level. The organization operates with the objective of a "No Profit/No Loss" basis over a period of years.

3.13. In regard to hybrids many States have Foundation Seed Agencies. In the State of Mississippi, the Foundation Seed Programme is operated through the Agricultural Extension Services who have a monopoly of varieties bred by public institutions. The extension services arrange for production by contracting with farmers. Certification is done by the Mississipi Seed Improvement Association which is the official agency in the State. In Indiana, an organization called the Agricultural Alumni Seed Improvement Association Inc. was formed by the Alumni of the University who felt the need for founding an organization for foundation seed production. This Association has an agreement with the Purdue Agricultural University, under which it has sole rights for multiplying the foundation seeds of varieties evolved by the University. In return for this privilege, the Association pays a certain fixed sum which is earmarked for crop research. The Association is solely run on income derived from sale of foundation seeds and payments received for services rendered. There is no subsidy of any kind. There is no division of profit among the members and no federal income-tax is paid. Any profit left after meeting the expenses and payment to the University is retained and used to meet capital expenditure, cost of expansion of services etc. The Association organizes production on its own farms. It has its own processing and storage facilities. Certification is done by an independent agency, the Indiana Crop Improvement Association, which is the certifying agency for the State. There is a similar foundation seed organization in the State of Illinois with the difference that it is an organization of seed growers of that State.

3.14. In Nebraska, foundation seed production is under the University of Nebraska. It is a self-supporting branch of the University and its profits are ploughed back for research purposes. It works under the Chairmanship of the Head of the Agronomy Department of the University. In California also the Agronomy Department of the University of California, Davis, produces foundation seeds of varieties bred by the University and approved by the Technical Committee of the Agronomy Department. It may be mentioned that a number of private seed companies in the United States produce their own foundation seeds as most of the hybrids marketed by them are the ones developed by their own Research Departments.

3.15. Foundation seed is much costlier to produce than certified seed. The Team was, therefore, interested in the price of foundation seed particularly of single crosses and male sterile lines for hybrid maize and hybrid sorghum respectively and made enquiries regarding the same in the U.S.A. where hybrid maize and hybrid sorghum are widely grown. As against the maize grain price of 30 paise per kilo, single crosses of maize were being sold between Rs. 18 to Rs. 40 per kilo. In sorghum, as against the grain price of 47 paise per kilo, the sale price was approximately Rs. 14 per kilo. It may be mentioned that the relatively good margins in foundation seeds are related to the costs of maintaining a large number of lines and the various services offered and risks undertaken in the operation. All the foundation seed organizations mentioned that the pricing of foundation seeds is done on the basis of market conditions and not on any formula of fixing particular margins. The point to be noted is that certified seed producers were rightly more anxious to obtain quality seeds and services than in possible price reductions.

3.16. In Japan, breeder and foundation seeds of rice, barley and wheat are produced by the National Government on its own farms. The breeder seed is certified by its breeder or his colleagues for its genetic and mechanical purity. Foundation seed is produced from breeder seed without any intervening generations. Foundation seed of one generation is not used to produce foundation seed of another generation. Foundation seed as well as registered and certified seeds are certified by National Crop Inspectors who are under the Crop Inspection Agency under the Ministry of Agriculture and are independent of the producing agencies of the National Government. In the Philippines, the foundation seed is produced by the Bureau of Plant Industry, the college of Agriculture and the International Rice Research Institute.

Seed Processing

3.17. The mechanical processing and packing of seeds has made tremendous strides in the countries visited. The Team had the opportunity to visit a number of processing plants handling different types of seeds and with varying capacities. Crop drying systems are always used and the method of drying varies from crop to crop. A number of sophisticated cleaning equipment like magnetic separators, aspirators, specific gravity separators and electronic-eye sorters are being used. In hybrid maize seed, grading and sizing has advanced considerably to help mechanical planting. Some seed companies have gone to the extent of supplying planter plates to help in planting.

3.18. To enable seed companies to keep pace with the progress in Seed Technology, there are institutions to provide requisite services. In Mississippi, the State University Seed Technology Laboratory provides services to companies that cannot afford to do their own research in the matter. They provide training and advisory services. Problems relating to production, processing, packaging, quality evaluation, marketing and distribution, methods of storage, packing and drying are under constant study. Special studies are carried out on problems that are referred to the laboratory. Advice is given free of charge to companies in the United States.

3.19. Another organization, viz., the Corn State Inc. in Iowa State provides a commercial consultancy service in the U.S.A. This company assists firms by planning, designing and engineering of processing plants. They also arrange supply of equipment if the clients so desire.

3.20. The seed testing laboratories in the Netherlands provide advisory services to seed companies. Layouts and machinery are recommended though the final choice is left to the seed companies. The service is charged on the basis of the time spent on each request.

Seed Marketing

3.21. The most striking feature in the agriculturally advanced countries is the role played by trade and industry in meeting the needs of farmers in respect of seeds. There is a vigorous seed industry in the U.S.A. with a number of companies of varying sizes competing with one another to secure the farmers' custom. The larger companies have their own research departments and introduce many varieties under their own names. Most of the production of such companies is arranged principally through contracts with farmers. In such contracts the companies supply foundation seeds and provide technical supervision. The farmers incur the costs as if they are growing a normal grain crop, while the specialised expenses of seed production are borne by the company. The purchase price paid to the farmer is slightly higher than the prevailing market price. In some cases an income per acre is guaranteed. In the case of ordinary seeds like wheat, some companies offer a specific premium over grain prices at the time f delivery. Option is given to the farmer to deliver the produce at any time between November and April. Hedging through forward markets is adopted by some companies to cover the risks arising from fluctuations in prices.

3.22. It is, however, the sales organizations of these companies, which were most impressive. Some of the companies have developed their markets through farmer-dealers. Typically, this involves selection of a good farmer who grows the company's seeds and also propagates in his area. It was, however, noted that the system of farmer-dealer is not equally successful everywhere and many other types of retail-outlets and particularly co-operatives distributing the requirements of the farmers are being effectively used. The companies spend considerable amounts on market development and market research and have a number of well-trained salesmen covering different territories. The good margins obtaining between purchase and sale prices of seeds enable the companies to invest in market development work and facilitates the orderly growth of the companies and helps the farmers obtain better seeds every year. Alongside the large companies, a number of medium and small companies and co-operatives also flourish and provide keen competition. There are many successful and efficient co-operatives in seed production.

3.23. Organizations of seed companies, seed growers and seed dealers have played an important part in developing seed industry on healthy lines. The American Seed Trade Association, the International Crop Improvement Association as well as many other organizations at State level have considerable influence both within the trade and outside. The same is true in varying degrees of most of the other countries visited by the Team.

Quality Control

3.24. All the countries visited had formal legislation governing the quality of seed marketed in respective countries. In Sweden, the Seed Act was passed first in 1928 and the Act was amended many times, the last amendment being in 1961. In the Netherlands, the latest amended Act is as recent as 1967. In Japan, the Main Crop Seed Law was passed in 1952 and amended in 1953. There is a separate Seeds and Seedlings Law of 1947 governing transactions in vegetable seeds. In the United Kingdom, there has been Seed Legislation since 1920 and a very comprehensive Act has been adopted in 1964. In the U.S.A. there are Federal as well as State legislations. All the seed legislation is in governing the quality of the seed and this is sought to be achieved by insisting that all the seeds which are marketed should be sold in containers which are properly labelled. The legislations are essentially truthful labelling laws to ensure that the buyer knows what he is buying. Government Inspectors check the samples to ensure that the labels provide correct information. In the United States, the laws do not usually provide for minimum standards of germination, freedom from weed seeds, etc. Such minimum standards are, however, laid down in the laws of United Kingdom for vegetable seeds and for certain seeds and generally in Sweden and the Netherlands as also for the main crops in Japan. In addition to the provisions for truthful labelling and enforcing of the same, the laws of Sweden and the Netherlands provide for certification of the crops through various agencies. In the Netherlands certification is carried out through organizations of seed growers and seed companies while in England, the seed certification work is carried out under the control of the seed testing laboratory. In England, the National Institute of Agricultural Botany is in charge of certification. In the United States, there are a number of certification agencies in different States. In some States certification is carried out by the agricultural universities and Departments of Agriculture while in most others, this is carried out by seed growers' and producers' organizations. In Japan, for the main crops, certification work is carried out through the prefectural organizations but the final certification rests with the Technical Officers of the National Government. In the Philippines, though there is no Seed Law, certification is carried out by the Bureau of Plant Industry. Certification is voluntary in all the countries except in the Netherlands and Sweden where it is compulsory for certain crops. In Japan also, certification is compulsory for the main crops and seeds which are not subject to tests are not allowed to be sold. Seed certification is essentially a means of verifying the trueness of the variety from the botanical and genetic point of views. The primary means of such verification is field inspection but many other checks and controls are possible and are adopted including administrative verifications of some of the seeds and growing of samples in fields as a check in comparison with standard samples.

INTERNATIONAL ORGANIZATIONS

3.25. This section on the more important feature of the seed industry will not be complete, without reference to the growing international character of the seed trade. There are currently three international organizations besides the Food and Agriculture Organization of the United Nations, who are interested in seed development. These are the International Seed Testing Association, Wageningen, the Netherlands, which is interested in securing uniform testing methods and procedures, the Organization for Economic Cooperation and Development with its headquarters at Cambridge, England, which is developing seed certification on an international basis and the International Crop Improvement Association, an organization covering the United States and Canada which, apart from bringing the seed trade of these countries together, has done considerable work in developing standards of seed certification. Reference must also be made to the Federation of International Seed Trade, which represents the seed trade in many countries and to the International Association of Breeders for Protection of Plant Varieties. Many of the seed companies in Japan, Europe and in England have flourishing export trades and have representatives in foreign countries. Some of them produce the seeds needed by them in foreign countries. Many firms in the U.S.A. have, in addition to export trade, established branches operating in different parts of the world. Some of them have established foreign subsidiaries to which they contribute part of the equity and technical know-how. Some of these companies have also stationed their research personnel in different parts of the world. Above all, mention should be made of the foundations like the Rockefeller Foundation who have assisted the seed improvement programmes in many countries, the Ford Foundation who along with the Rockefeller Foundation have financed the International Rice Research Institute, Manila. Their activities have led to considerable exchange of technical know-how and breeding of genetic stocks among various countries and given a new impetus to agricultural research and productivity in many parts of the world. A happy result of the activities of the international organizations is the increasing standardization of procedures and methods which help the international trade considerably. For example, a look at the colour of the tag reveals the extent and type of quality control applied to a seed lot.

Tags issued by/under the authority of ISTA		Tags issued by/under the authority of OECD	
Colour	Type of check	Colour	Class of Seed
Orange Green	Issued when sample is drawn from a lot in a prescribed manner, when sampling and testing are in the same country orange tags are used. Green tags are used when the lot is sampled in one country and analysed in another.	White	Basic seed
		Blue	Certified seed 1st generation
		Red	Certified seed second or subsequent generations.
Blue	Issued when a sample is tested without its being drawn from a lot in the prescribed manner		

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CHAPTER 4

SEED INDUSTRY IN INDIA—PRESENT AND FUTURE

4.1. The statistics given in Appendix III indicate that even very conservatively the farmers use every year seed worth about Rs. 300 crores. It is, of course, not necessary for the farmers to buy seeds every year. In most of the crops, the farmer can and does save the seed from the previous crop. But if agricultural productivity is to be maintained, the farmer must renew the seed once in 3, 4 or 5 years depending on the nature of the crop and in the case of hybrids, he has to purchase the seed every year. Allowing for these factors, the annual turnover in the seed trade in India can be about Rs. 100 crores. This value has been estimated at conservative levels and at fairly low seed prices. As seed industry develops and as superior and better varieties become available, there is no doubt that the volume and value of seed trade will also increase correspondingly.

4.2. The task of the seed industry is to provide to the farmer seeds of the latest and the best varieties bringing the fruits of research to the farmers' doors in the quickest possible time. Needless to say, the seed industry must ensure that the seed that is supplied to the farmer is of assured quality, genetically and physically, and is made available to him in time and at a place within his easy reach. The importance of the timely availability of quality seed to the farmer is of great concern to the country as a whole, as all the agricultural production programmes mainly depend on the availability of quality seeds responsive to fertilizers and other inputs on which heavy investments are being made. No investment can be considered to be too high and no effort too great in order to secure in full measure the objectives of the seed industry referred to above.

REGISTRATION AND RELEASE OF VARIETIES

4.3. First and foremost, the farmer must get a variety adapted to the agro-climatic conditions of his area. Different systems are adopted in foreign countries to achieve this aim. In Sweden and the Netherlands till recently, no variety could be marketed unless it was approved by an official committee mainly of scientists. Recently, however, there has been a liberalisation in this regard and these countries have adopted the pattern long prevalent in the United Kingdom requiring that all varieties must be registered officially as distinct from existing varieties and homogeneous in character. It is not, however, necessary that a variety should be officially released before it can be marketed. These countries rely entirely on the farmer's discretion in the choice of varieties. The farmer, of course, is assisted by the extension agencies in making such choice by the periodic publication of the results of trials conducted officially. In the United States, the restrictions are still fewer. Compulsory registration of varieties is not required prior to marketing. In other words, anybody can market seeds of any variety so long as he truthfully labels the variety and indicates the percentages of germination and other quality factors.

4.4. In India, there have been no restrictions so far on the marketing of varieties. The position is thus similar to that prevalent in the United States. However, it has to be recognized that there have been few private varieties offered in the market for sale to farmers. Most of the varieties marketed in India have been evolved by public research institutes which are subject to their own internal discipline and have generally been cleared by official committees of scientists either at the State level or at the Central level. The position in practice, thus, is similar to that obtained till recently in Europe.

4.5. The Team examined a number of witnesses and heard a number of experts on the best system suited to our conditions and to our context of agricultural development. There were a few who were in favour of compulsory official release of varieties on the ground that the farmers who were generally ignorant may be misled by publicity and may be exploited by those offering spurious varieties. On the other hand, it was felt that the farmer was the best judge of what variety suited him most and there should be no attempt to restrict his field of choice by official regulations. The Team took into account the various agruments put forward in support of a compulsory registration of varieties. Apart from the fear of exploitation referred to above, it was argued that the risk to food production from spurious varieties was too great to be ignored at the present moment. It was also pointed out that extension agencies would be enabled to advise the farmer correctly in respect of new varieties only if they are first tested officially. After a careful consideration of the views expressed, the Team is of the view that the fear of exploitation as well of risk to food production from new varieties that are not officially released are rather exaggerated. It is unlikely that a new variety will be grown on very large acreages in the very first year of release. Whatever the propaganda or publicity behind a new variety may be, only some very progressive and well-to-do farmers are likely to take to such varieties in the beginning and they too will try the varieties only on a limited area. The farmers will take to a variety on the basis of their actual experience. The spread of a variety in the initial years will be a gradual process. By restricting the freedom to market varieties to the farmers and by restricting the field of choice, we may be only slowing down the progress of agriculture without any corresponding advantage. It is not always necessary that the judgment of an official committee should prove to be superior in all situations to the judgment exercised by a number of farmers based on actual experience. The Team is, therefore, not in favour of a system of compulsory official screening of varieties before they are marketed.

4.6. On the other hand, the Team is of the view that the farmer should have the right to know the correct name of the variety which he is purchasing. When a farmer purchases the seed of a variety, he in effect purchases certain characteristics which go with it and inevitably compares these with the varieties which he had already grown. If the varieties are to be named correctly and truthfully, it is necessary to distinguish them clearly and avoid duplication of names for the same variety which leads to considerable confusion. The Team has taken note of the fact that such confusion had existed in many developing agricultural economies and that many of the developed countries felt that they should have taken timely action to prevent such confusion. India has a unique opportunity in the sense that with many of the new varieties that are now being released there is no confusion and the uniqueness of each variety with its characteristics is well established. This position must be consolidated and for this purpose, a system of registration of varieties is essential. The Team recommends that it should be made compulsory by law, either by amendment of the Seeds Act, 1966, or by other means, that no variety may be marketed unless it is registered by an official agency. Such indexing or registration will be based on tests for the uniqueness of the variety, i.e., on distinguishing botanical characteristics. It will not require the comparative testing of varieties and their comparison with existing varieties for establishing agronomic superiority. Even in the matter of testing to establish the uniqueness of the new variety from a botanical point of view the registration authority may accept the claims made by the breeder without necessarily insisting on a test or trial. It is up to the registration authority to arrange for such trials if it feels that it is necessary in a particular case.

4.7. The Team is of the opinion that registration should be done by a Committee constituted by the Government of India. This Committee should include scientists.

4.8. While the Team is in favour of allowing freedom to market varieties without a compulsory official screening prior to release, the Team does not underestimate the role which the Variety Release Committees have to play in the agricultural development of India. Varieties taken up in official programmes of the Central and State Governments should ordinarily be approved by either the Central or State Variety Release Committees. The Team took note of the fact that Variety Release Committees have been constituted in almost all the States and by the Central Government though these may have different names. These Committees which are generally broad-based consisting of scientists, administrators and other agricultural experts, screen various new varieties being offered by the research workers and recommend suitable varieties for cultivation. The Team recommends the following procedure for the release of varieties:—

> A Variety Evaluation Committee should be set up in the Agricultural University or other premier research organization in the State. Research data on experimental plots for two years should be considered by this Committee. If it is satisfied, in the third year testing may be organized on farmers' fields along with tests in experimental stations. The testing in farmers' fields would be taken up through the extension agencies. At the end of the third year, the variety may be placed before the Variety Release Committee based on three years results including the results from farmers' fields. Where a variety is outstanding, the period of testing could and ought to be cut down.

4.9. The Team is also of the opinion that ordinarily after three years' testing it should be possible to either release a variety or discard the same. Continuing the testing of doubtful varieties means wastage of scientific effort and if the variety is good, it means delay in the utilisation of the result of research by farmers.

4.10. The Team also considered the role of the Central Variety Release Committee and its relation to the State Variety Release Committees. Each State Variety Release Committee is responsible for the release of the varieties within the State. *Prima facie* it might appear that the Central Variety Release Committee has now started to function for the entire country. This inference, however, would not be quite correct. There are now a number of co-ordinated schemes wherein trials are organized on an all-India basis. The Central Workshop of scientists meets every year and recommends the varieties that may be released on an all-India basis indicating the regions for which the varieties are suitable. Such proposals emanating from the Workshop can best be placed before the Central Variety Release Committee which can quickly evaluate the results and evaluate the variety on an all-India basis. It would be a waste of time and lead to much confusion if the recommendations of the Workshop are to be placed before 17 Variety Release Committees in different States. Further, there is no particular advantage in adopting such an approach. It is true that the Central Variety Release Committee is not fully representative of all the different States, but it should be possible to enlarge its membership to provide representation to all States. If this is done and as the proposals coming before the Central Variety Release Committee would have been widely tested in different States, there should be no reason why a release by a Central Committee should not be as good as the release by 17 different States Committees. The releases made by the Central Variety Release Committee should, however, be placed before the State Variety Release Committees for their information to provide an opportunity to State Committees to review the position, if need be. The Central Variety Release Committee should also be responsible for prescribing standard procedures for the release of varieties and to make recommendations in this regard. It should also be charged with the responsibility of recommending varieties to the Central Government for purposes of special programmes. In order to perform its functions effectively it should have a much wider representation than at present. It is recommended that all the States be represented in the Central Variety Release Committee.

NEED TO AVOID PRE-RELEASE PUBLICITY

4.11. It was brought to the notice of the Team that while many new varieties were advertised in the papers and the radio, seeds of these varieties were often not available and this had adversely affected the confidence of farmers. Also taking advantage of the demand for new varieties certain elements exploited the situation. The Team is of the opinion that pre-release publicity should be strictly avoided. It is but natural that scientists as well as others in their enthusiasm for progress and new discoveries had considerable publicity for many new varieties which are still under trial. Such a situation causes an unnaturally inflated demand for seeds of new varieties and many persons who do not fully appreciate the need for proper trials of seed multiplication start pressing for seeds which are not available. It should certainly be possible for the scientists and all concerned to exercise adequate restraint in the matter and not to publicise a variety until at least sufficient foundation seed stocks of the variety have been built up. It would be appropriate at this stage to make a formal release and indicate that seed production has been taken up and seeds would be available in the next season for planting by farmers.

4.12. Closely linked with the question of avoiding pre-release publicity is the issue of pre-release multiplication. We have stressed the need for avoiding unnecessary time lag between the research and its utilisation. Undertaking pre-release multiplication is a vital step which helps in the reduction of such time lag. As soon as it becomes evident that a variety is likely to be released and is a promising one, steps should be taken to increase both the breeder and foundation seed in anticipation of the final release. This will help the early announcement of the release of the variety and also a systematic multiplication of certified seed of the particular variety.

PRIVATE RESEARCH

4.13. The Team considered the role of private research in plant breeding in Indian context. So far, research from public funds was dominating. The Team is convinced of the need for an intensive private research in this field. A country of the size of India with its variety of macro and micro agro-climatic conditions requires diversified efforts. While public research will continue to be dominating for many years to come, private research must be encouraged. Genetic material must be made available to private organizations undertaking research. The Team, however, does not think it feasible to introduce a system of breeders, rights at this stage, though in the long run such a system may be useful. The Team also recommends that privately-bred varieties should be released by official release committees on the basis of the data furnished by the research organisation supplemented by a year of testing in Government research stations and on farmer's field.

BREEDER SEED

4.14. Breeder seed constitutes the basis of all further seed production. The quantity and quality of breeder seed available are, therefore, of primary importance. Breeder seed has to be produced at research stations. Facilities available at present in the research stations for production of breeder seed are very inadequate. Further, enough attention is not being paid to the various aspects of breeder seed production. There is no internal check on quality of breeder seed. The Team recommends that:

(a) Responsibility for production of breeder seed should be clearly assigned to specific institutions.

(b) Standard procedures for breeder seed production should be laid down for each crop.

(c) Requisite facilities in terms of personnel, processing equipment and storage should be provided at the selected research stations.

(d) An effective internal check on quality of breeder seed should be provided at all stations producing breeder seed.

FOUNDATION SEED PRODUCTION OF VARIETIES

4.15. The responsibility for foundation seed production is currently shared between the National Seeds Corporation and the State Governments. The Corporation produces foundation seeds of hybrids and undertakes initial increase of certain varieties of all-India importance and the States arrange foundation seed production of other varieties. The policy adopted by the State Governments in the production of foundation seeds of varieties goes back to the Second Plan when it was decided to set up one 25-acres farm in each National Extension Block to meet the full requirements of foundation seed. In practice many Governments set up larger farms, though rarely they exceeded 100 acres. The functioning of many of these farms was found unsatisfactory and the efforts in the Third Plan were mainly directed to improving their condition. The Team feels that the concept of small farms in each block was given undue emphasis on the ground of local adaptability of varieties. While local adaptability is important, seeds of locally adaptable varieties can be produced elsewhere also. Further in foodgrains widely adaptable varieties are now available. Inspections by plant breeders and provision of processing and other facilities become easier with a few large farms than with a number of small scattered farms. Again it is only on farms of reasonable size that good personnel can be attracted and provided a challenging task. The Team recommends that in future foundation seed should be produced on large-sized farms. The existing small farms may be continued for seed production of varieties of local importance but such of the farms which are not conveniently located and cannot be developed to serve a useful purpose even by providing additional facilities may be closed down.

FOUNDATION SEED PRODUCTION FOR HYBRIDS

4.16. The National Seeds Corporation was established as the agency for foundation seed production of hybrids in July 1963 and the Corporation has been multiplying inbred lines and single crosses of maize and male sterile and maintainer lines of hybrid sorghum and bajra to make these available to State Governments as well as to private seed producers. The Corporation has cold storage facilities for holding sufficient reserve stocks of foundation seeds and has established two farms specializing in foundation seed production of hybrids. The Corporation has established processing plants for this purpose. The Corporation proposes to increase its activities in the field of foundation seed production to cater to the entire requirements of the country in accordance with the policy of the Government of India and of the States. It is recognized that the Corporation is in a unique position due to historical circumstances and the experience it had gained in this respect and on account of its all-India character to mutiply and distribute foundation seeds of hybrids. The Corporation should, however, make full use of the facilities available at agricultural universities, State and Central Government farms for the multiplication of foundation seed. Also, as the volume of foundation seed produced in the country increases, such States which have the requisite facilities may develop a single foundation seed agency for the State. There should be only one agency in a State at the most—the National Seeds Corporation continuing as an inter-State agency catering to the needs of those States where State agency has not developed and for those seeds which are of inter-State importance. When many States develop their own agency, there will be need for co-ordination which can be brought about by the Government of India constituting a committee.

4.17. In the Team's opinion, the production of foundation seeds of vegetables, grasses and fodder seeds as well as certain commercial crops like jute has not received adequate attention. Systematic planning in regard to the production of foundation seed in these crops and vegetables on the same lines on which the foundation seed production in hybrids and food crops are being planned should be adopted, as adequacy of foundation seed of good quality is of vital importance in the production programmes of the commercial crops as well as vegetables. The Team also recognizes the building up of a Central reserve stock of foundation seed by the National Seeds Corporation in respect of varieties of all-India importance in order to ensure a steady availability of foundation seed in the seed production programmes of different States and agencies. The Central reserve stock should in particular be built up for such crops where seed production may be strictly localized while the demand for seeds may be widespread in number of States where the risk of failure in seed production may be rather high.

4.18. The Team reviewed the arrangement for the production of foundation seed by State Governments as well as National Seeds Corporation and considered the question which often arises in this connection as to whether it is preferable to produce foundation seed on Government farms or on the farms of private farmers. The advantage of production on Government farms is that the risk of leakage of foundation seed in an unauthorised manner is very much reduced. Great care and supervision in respect of quality of seed is also possible. On the other hand, private farms with good facilities can give very high yields especially where personal supervision of progressive farmer is available. Many Government farms are located on poorer types of soil and may not reach the same level of intensive management. There is, however, no reason why as a rule yields on private farms should be higher or the quality of seed superior. The Team is of the opinion that foundation seed should normally be produced in farms owned by Government or quasi-Government institutions. The Team further recommends that foundation seed farms should be well-developed with land levelling, irrigation and drainage facilities and should be supervised by qualified technical staff. Adequate seed processing and storage facilities should also be provided. The storage for foundation seed should have controlled temperature and humidity.

Allocation Policy of Breeder and Foundation Seed

4.19. Breeder and foundation seeds are limited in the first one or two years of release of a variety and the demand for such seeds generally far exceeds available supply. It is, therefore, necessary to allocate foundation seed on a fair basis to various agencies producing certified seed or foundation seed as the case may be. Different procedures are adopted for this purpose in different countries. In the absence of definite policies for allocation, certain farmers who are in touch with a particular insitute may get hold of seeds of new varieties, multiply and distribute the same at exorbitant prices while persons and institutions regularly engaged in seed production and distribution may be enabled to obtain foundation seed or breeder seed of the particular variety much later. Such a situation can be avoided through a system of a clear-cut policy of equitable distribution of breeder and foundation seed. In this connection, the Team was impressed with the procedure developed at Purdue Agricultural University, a system adopted by many other research stations in the United States. We can do no better than to reproduce the policy statement evolved by the Purdue Agricultural University Experiment Station in respect of small grains. This is given in Appendix IV. The distribution of foundation seed amongst various seed growers should be made on the basis of past performance as reflected in certified seed production in the past years though weightage be given to facilities available with the different seed producers. The Team recommends that all research agencies and foundation seed agencies should adopt allocation policies prescribed by Variety Release Committees on the lines indicated above. Further, such policies should be made known to all prospective seed producers. A different type of allocation system will be needed by an all-India agency producing foundation seed on a national scale to meet the requirements of different States. In this case, the all-India agency should work out in consultation with Central and State Governments requirements of each State and make allocations that would be equitable keeping in view the area under a particular crop and the likely demand for the new variety in the various States. Such a policy, however, will not apply when foundation seed is supplied to a particular State purely for multiplication on the understanding that the State will not impose any restriction on the distribution of multiplied seed to other States.

Certified Seed Production

4.20. While the arrangements for the production of breeder and foundation seeds are important, the farmer is most interested in the arrangements for certified seed production. The farmer comes into contact with the agricultural research and with new varieties mainly through the certified seeds that are made available to him. He judges the entire programme only by the quality of the certified seed and only to the extent that certified seed truely reflects the original qualities of the seed evolved at the research stations which can bring the desired results in the farmers' fields. Technically, even foundation and breeder seeds may be certified and the term 'Certified Seed' may refer to those seeds also but in practice it is usual to confine the use of the term 'Certified Seed' to the seed which is used by the farmer for growing a crop to produce grain. In India, the term 'Registered Seed' has been widely used. The term 'Registered Seed' refers to an intermediate multiplication between foundation and certified seed. In respect of certain crops where the multiplication ratios are particularly low, it is necessary to have such an intermediate stage of multiplication.

4.21. At present certified seeds of hybrids are produced by the National Seeds Corporation, agricultural universities, State Governments, private seed companies, private seed producers and co-operative societies. These agencies generally produce seed on their own farms and also on contract with farmers. Generally speaking, contract with farmers is relied upon more than on production on own farms. The quantum of certified seed production required is so large that it cannot be produced on Government farms alone. It is the general policy of the Government of India that in the production of certified seed of hybrids as well as of varieties each State should be self-sufficient. Similarly, the State Governments have the policy of making each block self-sufficient in respect of seeds. The argument is advanced that seeds produced in a particular region will be more adaptable for growing in that region and hence decentralisation of certified seed production is desirable. In the opinion of the Team, however, the areas of certified seed production should be determined by the natural advantages of different regions. Areas where good quality seeds can be produced without risks of diseases, pests or failures should be preferred. Quality of seed produced, reliability of seed production, yield per acre, cost of seed production, facilities for storage and transport should be the considerations determining areas of seed production. It may be noted that in Japan also, an attempt was made to make each small administrative unit self-sufficient in respect of seeds and that this has been given up in favour of specialized seed production areas within each prefecture. We have to examine whether our country should aim seed production efficiently within each district or within each State or whether we should have seed production on an all-India basis allowing areas of natural suitability to specialise in seed production. It is true that there are a number of varieties which are not widely adaptable and in these cases localised seed production is inevitable. But on the other hand there are a large number of varieties and hybrids which are widely adaptable and the Team would suggest that the entire policy in the matter should be reviewed to enable free inter-State movement of seeds so that the best areas ultimately come to specialise in seed production. In this connection, the Team is glad to note that the seeds certified by the National Seeds Corporation are exempt from movement restrictions. With the establishment of various certification agencies, it may be expected that all certified seeds would be so exempt. In addition, exemption from movement restrictions should apply to all seeds which are properly labelled in accordance with the provision of the Seed Law.

Balanced Regional Development

4.22. While the Team favours specialisation of seed production in suitable areas, the requirements of balanced regional development have to be kept in view. India is a vast country and every State has within itself large areas with varying soil and climatic conditions. It should be possible to locate suitable areas in each State so that each State becomes self-sufficient in respect of certified seeds. This is so because the area required for seed production is relatively small in relation to the total irrigated area in each State. If today some States are more backward in seed production than others, this is not so much due to any natural deficiencies but due to either the availability of better paying crops or due to the fact that the administrators concerned in these areas have not given sufficient impetus to seed production. It should be possible to remedy such regional imbalances. The doctrine of self-sufficiency within each State needs to be modified only to the extent that advantages of seed production outside the State are very obvious as will be the case with respect to certain crops and particularly in respect of off-season cultivation to increase total availability of seeds.

Problems of Seed Production

4.23. The Team paid particular attention to the various problems faced in seed production, particularly in hybrid seed production. The Team was impressed with the advantages of specialization in seed production. If the same farmer continues to produce seed year after year, he will obtain an expertise which will not otherwise be possible. Seed production is a specialized job and the sooner it is recognized the better it is for the improved seeds programme. The Team recommends that initially farmers should be selected for seed production on the basis of varieties available with them. But in the early stages, seed production with new farmers should be taken up only on a limited scale. As a farmer demonstrates his interest in seed production and his ability for high quality seed production, he should be consistently kept in the programme and allowed to become a specialized producer of seeds.

4.24. Further, seed production should, as far as possible, be in compact areas. It is recognized that it may not be possible to get large compact areas under seed production of a particular variety. But it may be possible to develop certain villages for seed production so that a large number of farmers in particular villages take to the task of seed production. Such concentration in particular villages or other specialized areas helps in the inspection of the seed crop and also has the advantage of solving some of the problems of isolation. There are, however, many practical difficulties in developing seed villages. Further, the problem of isolation cannot be solved fully without recourse to some legislative action. It would appear that the Government have sufficient power under the Essential Commodities Act to destroy contaminating crops. If, however, these powers are not adequate, Government should not hesitate to arm itself with legislative power to destroy any crop that may contaminate a seed crop so that the purity of the seed crops may be maintained in public interest. It may be noted that such legislation already exists in respect of vegetable seed crops in Jammu and Kashmir where under the law only specified varieties may be grown in certain notified areas. While on the subject of isolation it may be pointed out that isolation standards which have been adopted from the foreign countries should not be applied as a matter of course. There is need for evaluation of these standards with reference to the conditions prevailing in our country especially velocity of wind, etc. It is recommended that the Indian Council of Agricultural Research should take up a co-ordinated scheme to determine the isolation requirements appropriate for various crops including vegetable crops in the different potential regions in the country. Similarly, there is need for a careful study of many seed production problems that arise particularly in hybrids. When the hybrid sorghum became available, problems connected with production of hybrid seeds had not been studied adequately with the result that there was considerable difficulty in the nicking between the male and female parents. To avoid such situations, it is recommended that wherever difficulty in seed production is anticipated, seed production studies should form part of other co-ordinated research schemes. The quality of foundation seed is of the greatest importance in securing high-quality certified seed production. We have already referred to the need for the quality in respect of breeder seed. Arrangements for quality control at foundation seed production level require special attention. These arrangements had hitherto been mainly based on inspections by the staff of the National Seeds Corporation or State Governments and sometimes from the research institutes. These arrangements should be put on a systematic basis. Arrangements should also be introduced for pre-control and post-control on foundation seeds by growing the inbred lines, single crosses etc. on a sample basis against standard samples. It is understood that the National Seeds Corporation has already set up a quality control unit for such work. This is a welcome step. As regards the foundation seeds of varieties handled by the State Governments such control plots may be organized by the agricultural universities or research institutes.

4.25. The availability of inputs and technical guidance must be assured to the farmer. Some detailed recommendations have been made in Chapter-7 and we wish to highlight the necessity of specialised equipment for planting and harvesting of seed crops. We would also like to point out the need for an adequate premium to the grower of seed so that he has requisite incentive for taking special care of the seed crop. Such a premium will also ensure that seeds are fully procured and are not used as grain.

Seed Processing

4.26. As important as the introduction of new varieties is the adoption of new technology in seed processing. The main objective of seed processing is to preserve the viability of the seeds from harvesting till sowing. Seed processing also helps to remove all foreign matter and contaminating material including weed seeds. Seed treatment is an essential part of seed processing, and both fungicides and insecticides are used for this purpose. The main aim of seed processing, namely, of preservation of viability is achieved by artificial drying. By controlled drying it is possible to bring down the moisture content of seeds uniformly as desired. In the case of maize, for example, the harvesting of the seed crop can commence at 30 per cent moisture content and it is usually brought down to 12 per cent. If longer storage is required, as with foundation seeds, the moisture can be brought down still further. For many vegetable seeds which have to be canned and transported under adverse conditions, drying has to be effected up to 5 per cent.

4.27. There is a feeling that under Indian conditions, artificial drying is not necessary. It is accepted that in the kharif season in the South, as well as in other areas where there is humidity and rainfall at harvest time, artificial drying is essential, but in the North, the kharif harvest is followed by dry weather and long days when the grains dry under natural conditions. Even the rabi crop, which is harvested in March, has a period of 2-3 months for drying. Also, farmers have been used from time immemorial to drying their seeds under natural conditions. These arguments, however, cannot be considered valid where large quantities are to be handled rather quickly. If maize is harvested at 30 per cent moisture, the moisture must be brought down to 12 per cent within a few days. Even with crops which are harvested at lower or safe moisture percentages, it would be better to dry them artificially so that the seed stocks could be processed without any delay and the risk of contamination etc. kept to the minimum. Also uniformity of drying is of great importance. When seeds are dried artificially by blowing of hot air through the seed lot, the drying tends to be more uniform than under natural conditions. It must be admitted, however, that there are no studies available on the costs of drying related to its benefits. The costs of drying will vary from place to place and from crop to crop. It is necessary to undertake detailed studies on this subject and provide for drying facilities wherever necessary. It may be pointed out in this connection that though a number of processing plants use kerosene or furnace oil for heating the air, there are a few plants where empty cobs and other local materials are being used. The possibility of using electricity as a source of heat should also be explored tho .gh it was felt that this would be a costly proposition at present.

4.28. When artificial drying of seeds is undertaken it is necessary to have sufficient temperature control. If the temperature exceeds 110° F, the seeds are likely to lose their viability. If the temperature remains at a low level, the seeds are likely to develop molds and get spoiled. The dryers imported from abroad have thermostats which can put off the burner as the temperature rises towards the maximum and restart the burner when the temperature comes down. Such essential control should be made automatic and should not be left to manual operation.

4.29. Next in importance to drying is the cleaning of seeds. Farmers have always known the value of good clean seeds. Effective cleaning requires the adoption of suitable mechanical means depending on the nature of the crop, condition of the lot and extent and type of contaminants. There are many types of cleaning machines but the primary model widely adopted in the country is the two screen air model. In this, the seed to be cleaned is fed through a hopper to a machine over two screens. The first screen allows good seeds to drop in and all material larger than the average good seeds ride over the screen openings and drop out. This is known as scalping. In the second screen, all undersized particles and small seeds fall through the holes and the good seeds ride over the screen. This is known as grading. The air-screen machines also provide for aspirations, i.e., blowing of air as seed falls through. This removes all light materials. The numbers and types of cleaners used in the advanced countries are varied and many and they make use of different principles taking advantage of the differences in the physical properties of seeds and their contaminants.

4.30. An important aspect of cleaning is the grading and sizing of the seeds. This is important especially when mechanical means are adopted for planting. In maize, for example, planter plates are available for different sizes of seeds. If sizing is not properly done, more seeds may fall at one place while planting, while no seed may go through the planter at other places and an irregular stand of crop would be the result. As mechanical planting develops in India, grading and sizing will assume special importance. Even otherwise well-graded seeds have good appearance and will attract the farmers more. Further, it is easy to estimate the quantity of seeds by weight required for planting an acre if the seeds are uniformly graded. It is recommended that grading of seeds should be introduced in India. To start with the number of grades may be kept to the minimum. A suggested scheme of grading is given in Table II.

4.31. Next to grading, seed treating is the sequential operation. The object of seed treatment is to apply insecticides and fungicides uniformly to seed lots, so that they are protected from insects and fungi. In most of the maize processing plants in India slurry treaters using wattable powder are being adopted. It is necessary to avoid overdoses of insecticides as it might affect the viability of seeds. There are also many other types of machines using not only slurries but also dusts for purpose of seed treatment. Experiments must be commenced on the use of different seed treatment materials and different types of machines under our conditions.

4.32. All the efforts taken in inspecting seed lots from the time of sowing to processing and all the care taken to preserve their viability through proper seed processing would be of no avail if steps are not taken to prevent adulteration of seed lots and for identification of particular lots. The processed seeds are, therefore, generally packed in convenient cloth or gunny bags and sealed. Lead seals or tin seals are used for sealing and the effectiveness of sealing is of great importance to the seed industry. It appears that tin seals currently being made in India are not of the requisite quality and need considerable improvement. Further, for closing of the cloth bags and gunny bags, bag-closing machines are needed. These would be required not only by the seed industry but also by the fertilizer and insecticides industry. The fertilizer mixing firms, for instance, should welcome the availability of bag closer. A large number of machines may thus be needed. In fact the lack of indigenous availability of quality machines for seed processing is the most serious bottleneck in the development of processing facilities in the country. It is clear that the indigenous capacity will not develop for a long time to come as a matter of course. It is up to the government to provide a push in this direction. There is considerable interest amongst manufacturers in the seed processing equipment. The National Seeds Corporation and the Rockefeller Foundation have assisted a number of prospective manufacturers by providing designs and prototypes and placing orders. These efforts have led to the manufacture of many items of seed processing equipment within the country. Satisfactory moisture meters are also being made. However, there is still dearth of quality cleaning machines of sufficient capacity and as already pointed out bag closers are not being made within the country. The dryers that are being manufactured at present require further improvement. The Team visited a number of manufacturing firms in different parts of the country and was impressed with the progress already made. The manufacturers were confident of meeting the quality standard and improving the present design. They, however, felt that they would need some foreign exchange for importing some specialized parts. It is stated that the value of these parts would not exceed 10—15 per cent of the value of the machines. It is recommended that the import may be allowed for specified parts to meet the requirements of particular programmes for manufacture of quality equipment required for seed processing.

4.33. Even more important than the availability of suitable equipment is the proper management of processing plant. First, the processing plants must be designed to meet the specific requirements of the situation. There are different methods of drying. For example, the batch drying system is usually preferred in maize but continuous drying is adopted for paddy. It is necessary to choose the most appropriate system for drying, cleaning, etc., keeping in view both the crops and the quantity to be handled. The degree of mechanisation should also be decided keeping in view the local availability of labour. In the advanced countries all the intermediate handling of seeds in the processing plant is mechanised through the use of conveyers and elevators. It may not be necessary to adopt such methods in India as labour is available in plenty. The location of the processing plant is also of great importance. The location must be central to the areas of seed production. It is sometimes argued that it would be better to locate the processing plants near the market. But it would be preferable to have the processing plant as near to the areas of producion as possible. It is easier and cheaper to transport the processed seeds to marketing centres than to transport the unprocessed seeds. The processing building should provide for adequate storage for both the raw seed that is brought in for holding seeds at various stages of processing and for holding some of the finished seeds.

4.34. The management of processing plants requires considerable managerial capacity. The economics of a plant depends upon smooth functioning of the different processes. The processing plant should never run out of stocks of seeds so that the machinery may not be idle. At the same time, the intake of raw seeds must be related to the drying capacity. Harvesting plans of seed growers must be made in consultation with the processing plant manager.

4.35. The survey of the seed processing facilities in India and its future requirements clearly show the need for a long-term policy aimed at developing sufficient indigenous capacity for manufacturing different types of equipment and short-term policy to meet the immediate requirements of high quality seeds for the improved seeds programme of the government. As part of the long-term policy there should be established a strong and well-staffed engineering and design organization which should devote itself exclusively for the study of problems of processing of different seeds, the types of equipment required, the specifications thereof, the problems of manufacture and design. Such an organization will undertake research and survey of designs of equipment and processing plant buildings. It will provide advisory services to seed producers furnishing them with blue-prints, best methods of processing, flow-charts, cost estimates, etc. It will also advise on procurement of quality equipment. In the initial stages, it may be necessary for the organisation to purchase, stock and sell quality equipment and spare parts thereof.

4.36. The organization will also provide assistance to the existing and prospective manufacturers of seed processing equipment. The manufacture of processing equipment will not, however, develop unless the manfacturers are certain of effective demand and unless the agencies, ordering equipment, emphasise quality rather than price. The Team recommends that a central agency should place advance orders on selected firms of manufacture of different kinds of seed processing equipment. The agency in turn can supply these equipments to the States and the seed producers. The Team is of the opinion that the National Seeds Corporation would be the most appropriate agency for locating the Engineering and Design Organization. The Corporation could also function as the Central Purchase Agency.

4.37. It was noticed by the Team that the firms in foreign countries manufacturing processing equipment built up their expertise over a long period of years. It would be useful to send engineers from corresponding firms in India for short study tours so that they may familiarise themselves with finer points of manufacture.

4.38. As the development of the indigenous capacity for manufacture of quality equipment will take time, there is no escape from the import of essential equipment for the next two or three years. These equipment will, however, be kept to the minimum. The Team is of the view that the need for such imports would arise only in respect of seed cleaners, bag closers and certain parts for other equipment. There would also be need for imports of new types and models of equipment from abroad in order to provide a base for continuous improvement in processing techniques. The Team recommends the import of these essential equipment.

Seed Storage

4.39. Proper storage is vital for all seed operations and we have already indicated the need for controlled cold storage for foundation seeds. In regard to the storage of certified seeds a flexible approach is to be adopted as the storability of the seeds and the climatic conditions vary widely. The question of storage has also to be considered at different levels like the village, district and the farms. The Team is of the opinion that ordinarily specialized seed godowns should be established at district levels which should be the wholesale storage points. At these districts godowns, there should be provision for control of temperature and humidity in those areas where the weather gets hot and wet. In other areas where the weather is more equable and humidity low, there would be no need for provision of air-conditioning. The seeds which remain unsold at village points at the end of each season should be brought back to the district headquarters and stored at the specialized seed godowns. Regular fumigation and periodic testing of seeds should be arranged at these godowns so that the viability of the seeds is ensured.

Seed Distribution and Marketing

4.40. Modern economic development is closely linked to the development of marketing systems. Efficient marketing links the consumer to the producer and helps to guide the research and development wings of industries. Again, it is the task of marketing to create awareness of the superiority of new products and to translate such awareness into effective demand. The marketing of seeds is no exception to the above rule. It is true, that in India marketing direct to the consumers is beset with many difficulties. First, the number of farmers to whom the seeds are to be sold is very large. Secondly, the capacity to pay is low in respect of most of the farmers. As the land holding is low, the unit value sold to each customer is also low. Further, seeds of field crops are required only once or twice a year. The funds employed in marketing cannot be very well rotated on account of this factor and consequently a higher margin of return is needed. Also, physical facilities for effective marketing are woefully inadequate in the rural areas. Transport and travel are difficult. Travelling salesman cannot easily find suitable accommodation for stay. It is not easy to come to reliable or enthusiastic dealers. Storage points at retail levels are unsatisfactory. As seeds can deteriorate and lose their value, the lack of storage and transport facilities at retail levels has particularly an inhibiting effect on rural marketing of seeds.

4.41. Some of the difficulties mentioned above would no doubt be overcome as marketing work develops. The building up of facilities in terms of roads and transport is developing. Storage facilities would no doubt develop as marketing programme develops. The lack of turn over can be got over by combining the retailing of different inputs or commodities required by the farmer. Dealers can be built up over a period of time. This is essentially a matter of selection and training. Credit facilities to farmers are being improved and farmers are increasingly in a position to pay cash for the purchase of seeds. Above all, developments in agriculture, namely, the larger availability of water, fertilizers, new varieties, change in cropping patterns, etc., are making the farmers forward-looking and provide a sound basis for a continuous expansion of the seed market.

4.42. Though the Royal Commission on Agriculture had exhorted 40 years ago that seed merchants of known integrity should be encouraged to market seeds, very little development had occurred over the years. Seed and nursery men have, of course, been playing a useful role in vegetables, flowers and seedlings of fruit trees. There has also been some trade in seeds of jute, green manure and certain other crops. In respect of field crops like paddy, groundnut, etc., there has been little organized trade, though farmers have always purchased seeds from various sources. Among these sources, neighbours, co-operatives and Departments of Agriculture have occupied an important place. Ever since the Grow-More-Food Campaign started towards the close of the last war and throughout the three Plans, the State Departments of Agriculture have assumed a leading role in distribution of seeds. Different patterns have, of course, been adopted by different States. Broadly, there are five patterns of distribution—

(*a*) ***Farmer to farmer distribution.***—This is a traditional method wherein farmers obtain their requirements from their neighbours either on cash payments or on exchange basis.

(*b*) ***Registered grower distribution.***—Many States distribute foundation seeds to registered growers, but do not undertake procurement. The registered growers are expected to distribute seed multiplied by them to farmers on cash or exchange basis.

(*c*) ***Distribution by co-operatives.***—Co-operatives may either on their own or under the stimulus of the Department of Agriculture, purchase and distribute seeds. They may even exchange seeds on Sawai basis, though this is disappearing generally. The distribution through co-operatives has been generally encouraged by the Government through subsidies and guarantees.

(*d*) ***Distribution by Departments of Agriculture.***—Seeds are purchased by the Departments of Agriculture using Government funds and are distributed through District Agriculture Officers and Block Development Officers. This system has been widely adopted.

(*e*) ***Distribution of seeds by private or quasi-Government agencies.***—This has generally been confined to certain selected seeds. Such distribution has developed recently in respect of high-yielding varieties.

4.43. The question as to the type of distribution that must be developed cannot entirely be left to the market forces. If market forces are to shape the volume and pattern of activity in seeds, agriculture progress would be considerably slowed down. There is necessity for Governments to take a clear-cut and long-range view as to the desirable shape of things and to work consistently towards the achievement of such a pattern. As already pointed out, the State Governments have played a predominant part in the distribution of seeds over the last 15 years. The question is whether this should be continued or alternative sources and patterns should be developed. There has never been any doubt that agricultural extension agencies should be relieved of supply functions. A number of committees have made recommendations to this effect.

4.44. When the extension agencies take up supply functions, extension work is bound to suffer. This would be extremely unfortunate as there is great need for intensive extension work. The results obtained at research institutes are not yet being realized at field levels. If the extension agencies are loaded with other activities, as in the past, they cannot be expected to be more effective.

4.45. Most of the distribution of seeds by the Departments of Agriculture has been through the extension agencies. Apart from the defect mentioned above, this is also open to the objection that it constitutes a hidden subsidy from the tax-payers' money. The full cost of distribution and in particular the risks attended thereto are not realised in the sale price. Further, the extension agencies have no particular incentive for market development work. In practice the system of distribution through the department or through a co-operative (except when the latter takes it upon a commercial basis) becomes a mere distribution arrangement and not a thorough marketing arrangement. Further there is no reason why Government funds should be involved in the matter if other sources are available. The approach to the Fourth-Five-Year Plan outlined by the Planning Commission recently, correctly lays emphasis on the mobilisation of institutional resources other than the plan. It is certainly true that agricultural development must receive priority and the meaning of priority is that the Government must be prepared to commit its funds for the supply of seeds and other inputs, if others are not prepared to invest funds in this field. But a determined effort must be made to attrac tinvestments by other agencies. Such investments can come from persons with sufficient resources, some knowledge and interest in agriculture and ability and willingness to bear risks and uncertainties. Commercial banks have also an important role to play in financing the development of a seed distribution system.

4 46. It is, of course, not desirable that we should make an attempt to develop a seed enterprise in private or co-operative sector merely on ideological grounds. If there is no reasonable basis for thinking that possibilities exist for such development and if a private seed enterprise is not likely to develop rapidly under appropriate conditions, it would be unreasonable to expect the Government to waste its energies in developing the same. The question, therefore, is whether adequate number of individuals and institutions would come forward and invest funds, for seed marketing work. Past experience is unfortunately no guide to the future in this regard. There has been a major change in agriculture as well as seed technology. There was never any substantial market in the past of seeds of field crops. It is only in recent years that such a market has developed. There has also been an interest generated in investment in agriculture. This is partly due to the tax-concessions which agriculture enjoys but partly also due to the fact that agriculture, for long the cinderella of India economy—has acquired a new status and prestige in recent years. We find that many agencies are showing interest in investing in seed enterprise.

4.47. The resources available and the ability to bear risks would vary with each agency. Their relative strengths and weaknesses are diverse enough to provide a basis for the development of a balanced and flexible seed industry capable of adjusting to changing situations. For example, farmers and farmers' associations may not be able to withstand a period of very low prices to the same extent as a company or co-operative with large resources and limited liability can. But farmers and farmers' associations have a built-in resilience. For example, when purchase prices of seeds are high and selling prices of seeds are low, farmers and farmers' associations may make up for their losses in sales by their gain in production. Further, they are likely to have deeper knowledge and interest in agriculture and are likely to take to this activity as a life-long profession. The Team is, therefore, of the opinion that while all agencies may be encouraged, special emphasis should be laid on the development of farmers and farmers' associations in the field of seed production and seed distribution.

4.48. The role of marketing co-operatives and of private business enterprise cannot, however, be minimised. These are the agencies capable of organizing sound market development work. These are the organizations which must have specialised expertise in new product development and in modern marketing techniques that go with it.

4.49. If we come to the conclusion that there is a reasonable hope of developing these agencies in the field of seed marketing, it follows that we should adopt policies appropriate to that development. The Team recommends the following measures :—

(1) To reach the high goals set for the future, a massive expansion of seed producing and distributing units is called for. Government should, therefore, through a policy declaration earmarking a major role, encourage the development of co-operative and private seed

processing, marketing and distribution organizations. As these organizations develop, the departmental agencies now engaged in the production, purchase and sale of seeds should reduce their activities in this direction.

(2) The departmental agencies should provide the general planning of the various programmes including fixation of targets and concentrate on extension functions.

(3) Purchase prices to growers and sale prices to farmers should be left ordinarily to be regulated by market forces. Co-operatives and Government undertakings as well as Departments distributing seeds should so fix their prices as to cover all their costs, overheads, the risks and write-off and provide a reasonable rate of return to the Exchequer. This is possible as by using high-quality seed, the farmer is able to get adequate returns. No subsidies or guarantees should be necessary in these circumstances.

(4) The promotion of medium-sized seed growers, production and marketing co-operatives should be actively encouraged in the initial stages through liberal financial assistance by the National Co-operative Development Corporation to cover adequately the investment and working capital requirements for setting up seed production and processing units.

(5) It is gratifying to note that the budget for 1968-69 provides tax concessions on expenditure incurred by firms using agricultural produce as raw materials in assisting farmers to grow better crops. Suitable tax concessions should also be provided to seed organizations on the expenditure incurred by them in sales promotion of seeds by provision of technical services. Such concessions should be available for an initial period of five years as this would encourage seed companies to undertake promotional work in rural areas.

Quality Control

4.50. The essence of any seed programme consists in quality control and seed is different from grain only if certain qualities which are important from the point of view of genetic purity are preserved carefully. The seed programme without quality control will, therefore, result in failure. There are various methods of controlling the quality of seed and chief among these are (a) seed certification ; (b) seed law enforcement. Common to both these methods are the facilities required for seed testing.

4.51. The term "Seed Certification" refers to certification of seed primarily for genetic purity though it is usual for the certifying agency to ensure that the seed certified conforms to at least certain minimum standards of germination, freedom from weeds, moisture, etc. Seed Certification requires the inspection of field crops to ensure that the minimum standards of genetic purity are maintained. During such field inspections the isolation requirements of such crops are checked. The plants are also checked for varietal purity and any off-types are rogued out. If the number of off-types are above a certain percentage or if pollination occurs other than in the desired manner, the field is rejected and is not considered fit for certification.

4.52. The National Seeds Corporation introduced certification of hybrid seed crops since 1963. Seed Certification is particularly important in respect of first generation hybrids as the farmers pay a high price for such seeds and will not obtain desired results unless the hybrids are truly the type of crosses which they were intended to be. Starting from hardly a few acres in certification the National Seeds Corporation certified 79,812 acres in 1967-68. Under the Seeds Act, 1966, the State Governments have to set up seed certification agencies. These agencies will certify not only the hybrid crops but also seed crops of other varieties. The Team discussed with the various State Governments the best manner of implementing the provisions of the Seeds Act. Great care has to be exercised in this regard as the seed certification is a specialised and responsible job. Most decisions will affect someone financially. When seed is rejected for certification, the seed grower is a heavy loser. If seed which is not up to the mark and standard is certified, all buyers of seed and those who market the seed will suffer. The agricultural programmes of the country will also suffer. It behoves one making decisions to ensure that certification requirements are definite, adequate and realistic and having laid down these requirements they are required to be adhered to equitably and with firmness. At the same time, co-operation between the seed grower, the seed dealer and the certification agencies is very essential. Firmness, must, therefore, be combined with a certain measure of tact and understanding and constructive attitude. Good relations are essential for effective certification. These requirements clearly indicate the need for utmost care in selecting a suitable agency. Much will, of course, depend upon the personnel, but the structure of the agency should be such as to minimize the difficulties and not to aggravate them. The Team is of the opinion that the first requisite for a certification agency is that it should be independent from the agency producing or selling the seed on the one hand and from the agency enforcing the Seeds Act on the other. Many possible agencies were suggested for this purpose. The State and Central Departments of Agriculture, National/State/Seed Corporations, agricultural universities, associations of seed growers, Agricultural Research Institutes or combination of these agencies were suggested. In the opinion of the Team any independent Board representing the various agencies listed above would be the most appropriate agency for undertaking seed certification. By providing adequate representation to seed growers and seed producers in such Boards, the requisite measure of co-operation and understanding could be developed and seed certification will be considered as a self-regulatory work by the seed producers rather than something imposed on them. It should be possible for such a Board to become financially viable by charging required fees from the seed growers whose crops are certified. Government will have to provide only the initial capital for such certification Boards.

4.53. As regards the process of certification, the Team feels that there is scope for improvement over the present methods being followed. Field inspection is of course the core of any certification work but other checks cannot be altogether ignored. The various checks to be considered in this connection are as under :—

(a) An administrative check of the origin and the propagating material for the purpose of determining trueness to variety, correct name in certification, i.e., source from which the seed is sown should be pointed out with reference to relevant documents.

(b) *Field Inspection.*—An evaluation of the growing crop for obtaining data of trueness to variety, varietal purity, isolation requirements to prevent cross-pollination and conditions as regards diseases, obnoxious weeds and admixtures.

(c) Supervision of agricultural and commercial operations of harvesting, storage, transport and processing with a view to preserving the identity of the lots.

(d) *Sample Inspection.*—An evaluation of the external quality, a laboratory test of a representative sample drawn by the certification agency. The laboratory test which may be carried out by an authorised station aims at determining the percentage of germination, moisture content, weed content, admixture and purity.

(e) *Bulk Inspection.*—An evaluation of the lot for the purpose of checking the homogeneity of the bulk as compared with the sample inspected.

(f) *Control plot testing.*—Samples drawn both from the source seed and the final seed produced can be grown in the field along with standard samples of the variety in question. By comparison it can be determined whether the varietal purity and the health of the source seed are equal on the results based on inspection. Causes of any anomaly have to be used to check purity of varieties where such purity cannot be effectively checked in field inspections.

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The extent of the above checks will depend upon many factors including the nature of the variety, the extent of cross-pollination and the conditions of cultivation, harvesting, processing, etc., and not in the least on the integrity of the various persons involved in the programme, which will have to be left to the discretion of the agency certifying the seed crop.

Seed Law Enforcement

4.54. Under the Seeds Act, 1966, seed certification is voluntary, i.e., all seeds that are sold are not required to be certified by the certification agencies. This is as it should be as certification is a difficult and costly process and it may not be necessary to have all the seeds of all varieties duly certified after full field inspection. There will, therefore, be considerable quantities of uncertified seeds being sold to the farmers. It is necessary to regulate at least certain minimum quality aspects of these seeds so that the farmer gets reasonable and satisfactory quality seeds even in respect of uncertified seeds. The Seeds Act must aim at this objective. It requires that all seeds which are sold in the market should be properly labelled to indicate the name of the variety, germination, percentage, freedom from mixtures, weeds, etc. The Act is essentially a truthful labelling Act by requiring the dealers to declare the above particulars to help the farmers to make the correct choice of variety and be certain that the seed would have good viability and be free from weeds and mixtures. In order to enforce the Act it is necessary to periodically sample the seeds that are being offered for sale or seeds which have actually been sold and to find if the seeds actually conform to the particulars declared in the label. The Seeds Act provides for such inspection and in case it is found that the seed does not conform to the particulars specified in the label, there is provision for seizure of stocks and for prosecution. The Seeds Act, however, will apply only to such crops and such areas as the Government may from time to time decide. The Government may also decide the form of the label and the contents that should be specified in the label. Also the Government may lay down certain minimum standards for germination, etc. If such standards are laid down, the seed dealers will have to conform to these standards. Exchange of seeds between farmer to farmer is exempt from the provisions of the Seeds Act. The Seeds Act, if properly enforced, will lead to the gradual upgrading of the quality of seeds being sold in the market. The dealers are required not only to declare the germination but be responsible for the viability up to the specified period. They have thus to provide packing of seeds. The Seeds Act will, however, help only to the extent it is implemented in a proper spirit in the early stages. The seedsmen will have to be assisted to conform to the Seeds Act and acts as seizure and prosecution should be very few. The co-operation of seedsmen is very essential and the Seeds Act enforcement agency can be considered to be successful only to the extent it is able to obtain full co-operation of the seed trade.

4.55. If the Seeds Act is to be implemented in the spirit it has been framed it is necessary to have inspectors of high calibre and undoubted integrity. It is not necessary to h.ve a large number of inspectors spread all over the country. The objectives will be better achieved if to begin with each State employs a limited number of inspectors who are well-qualified, mature and reliable to inspect various seed lots and educate various seedsmen and generally enforce the Act without hampering the trade in seeds.

4.56. It is also necessary to proceed carefully in the matter and take up pilot implementation of the Act in certain districts and crops. Certain records have to be maintained by seedsmen and seed producers to help enforcement of the law and seedsmen must be given requisite training in this regard. Further, in the light of the experience gained, the Seeds Act and the Rules thereunder will require modification. There should be no hesitation to amend the Act or the Rules if experience shows it to be necessary.

Seed Testing

4.57. The enforcement of the Seeds Act and the upgrading of the quality of seed would be impossible without means of accurately evaluating the germination and purity of seeds. Over the last few years, 17 seed testing laboratories have been established in India on the basis that each State should have one seed testing laboratory. Procedures have been prescribed and a number of personnel trained. The achievement of uniform and accurate results is vital for the success of the seed programme and much remains to be done to achieve this objective. We have given our recommendations in detail in para 10.39. These recommendations must be swiftly implemented and the standard of seed testing made entirely reliable as this would in the ultimate analysis form the basis of legal action where necessary.

Training

4.58. Between 1961 and 1968, 23 training courses have been organized on an all-India level and 515 persons have been trained in different aspects of seed improvement. Senior personnel have also been trained in foreign countries. The trained personnel are not, however, always available for seed work owing to administrative and other considerations. Even otherwise, there is need for intensive training at various levels and for various categories of personnel. The Central Government should, through the Indian Agricultural Research Institute and the National Seeds Corporation organize training programmes for senior personnel who in turn can organize training at State and District levels. The selection of persons for training and the utilisation of trained personnel also require closer attention. There should be adequate job opportunities within the seed programme if trained personnel are to be retained. The scales of pay for different posts in the seed improvement programme may be examined from this aspect.

Provision of Finance and Credit

4.59. Long-term and short-term finance required for seed production, distribution and marketing falls under three categories :—

(a) financial needs of seed growers ;
(b) financial needs of seed processors and marketing firms ; and
(c) financial needs of farmers for purchase of seeds.

4.60. Most farm lands used for growing seeds need to be properly developed. The normal tendency is to sow the seed crop on the best land available, avoiding areas that are not properly levelled or waterlogged. To bring more good area under seed production, investment is needed for land improvement and developing irrigation facilities. The cost of land improvement can be quite substantial. It is estimated that the average requirements for land development including requisite machinery for cultivation may work out to Rs. 5,000 per acre. This whould be needed as long-term and medium-term finance. To meet the cost of inputs and other short-term expenditure, an average of Rs. 800 to Rs. 1,000 per acre depending upon the cost would be a fair estimate. On the above basis and keeping in view the anticipated tragets of the High-Yielding Varieties Programme in the Fourth Five-Year Plan, the total long and medium-term finance for the next 3 to 5 years may be of the order of Rs. 200 crores of which it could reasonably be expected that approximately 50 per cent would be met from farmers' own resources. Short-term finance requirements are estimated on an average at Rs. 30 crores and part of these will, no doubt, be met by seed companies. On this basis, the finance requirements of seed growers could well be of the order of Rs. 100 crores during the next five years.

4.61. As regards the credit requirements of seed processors and marketing firms it is estimated that capital investments for plant and machinery, building and warehouses would be about Rs. 750 per ton for an economic-sized processing unit. The fixed investment required for provision of processing facilities to handle the volume of production required to meet the targets of the Fourth Five-Year Plan would be of the order of Rs. 30 crores. The Banks and other financial institutions may provide about two-thirds of this investment, the balance being met by the entrepreneurs as equity capital.

4.62. As for short-term finance, working capital would be needed at Rs. 350 per ton of processed seed to meet operational and packaging costs and the total credit requirements for this purpose would work out to Rs. 14 crores. In addition, a sum of Rs. 60 crores would be needed to finance growers for purchase of foundation seeds, inputs, etc., the total short-term credit requirements would thus be Rs. 75 crores for seed processors and marketing firms.

4.63. From the above assessment, it would be clear that the requirements of credit for land development and seed production are not very large in volume—being only about Rs. 100 crores—and the commercial banks should be able to find the resources. They are, however, handicapped in providing the credit as the same cannot be adequately secured. In the recent past, there has doubtless been an encouraging trend that the commercial banks have shown willingness to extend credit to seed growers. This trend can be strengthened and an increased volume of credit to cover both long-term and short-term requirements of finance can be made available from institutional resources provided a Government-backed Corporation could guarantee or under-write the risks involved. The Fertilizer Credit Committee headed by Shri Venkatappiah had recommended the formation of a Fertilizer Credit Guarantee Corporation. It is recommended that as seeds are vital agricultural inputs, they should also be covered by this Scheme along with fertilizers and insecticides.

4.64. Even more difficult problems arise in meeting the credit requirements of organizations which process and market the seeds. These organizations need funds to provide finance to growers for purchase of inputs and to cover some of the costs of farm operations. At harvest time, they need finance to purchase the produce of growers, to store them till they are sold to farmers several months later for commercial grain cultivation. A large volume of funds is, therefore, needed to ensure that the operations are carried out without interruption. The firms have experienced difficulties in hypothecating processed seeds. For unprocessed seeds no advances are made. In certain areas, it was represented that the banks value the seeds for purpose of advances only at grain prices. The working capital requirements of the processing and marketing organizations, are relatively high in relation to fixed capital requirements. These organizations are, therefore, unable to find adequate short-term loans and are obliged to meet the working capital requirements out of long-term loans and share capital. It is recommended that Reserve Bank should make it clear to all commercial banks that all seeds—raw or processed, certified or un-certified, whether produced in contract with State Governments or not, should be treated as agricultural inputs and not as grain for purposes of advance. It is also recommended that steps should be taken to guarantee advances made to seed producers and this should be included within the scope of the activities of the proposed Fertiliser Credit Guarantee Corporation to which a reference has already been made. As regards long-term finance, the various financial institutions should be able to provide the same. Such advances are necessary especially for cold storage facilities for seeds including seeds potatoes. It is recommended that financial institutions should provide advance for construction of warehouses for seed industry and such advances should be treated as advances to seed industry so that all benefits available to " priority industries" can be claimed.

Role of various agencies

4.65. A survey of the present situation in seeds indicates that a large number of agencies, government as well as private, are interested in the seed development programme. These agencies are mainly:—

1. The Government of India (Department of Agriculture).
2. The State Governments (Departments of Agriculture).
3. The Indian Council of Agricultural Research.
4. The Indian Agricultural Research Institute.
5. The National Seeds Corporation.
6. The State and Central Agricultural Research Institutes.
7. The Agricultural Universities.
8. The National and State Level Co-operative Marketing Federations.

9. The Co-operative Marketing Societies at village, block and district levels.

10. Seed Companies and Corporations.

11. Progressive farmers and their associations.

12. Joint Stock Companies and partnership firms interested in agriculture and particularly handling fertilizers, insecticides, etc.

13. Central and State Government farms.

14. Seed Growers' and Dealers' Associations.

4.66. The multiplicity of agencies dealing in such a vital aspect of agriculture is certainly to be welcomed. It would be difficult to lay down rigidly the precise task of each agency and to enforce the same. However, to avoid overlapping of activities and waste of efforts, it is necessary to demarcate the roles of these agencies in the seed development programme and adhere to such demarcation as far as possible.

4.67. The Department of Agriculture of the Government of India has the overall responsibility for guiding and co-ordinating the activities of the State Governments. The very process of planning at the national level makes this inevitable. By such national planning, the progress of seed improvement in different States can be expedited. The Central Government has also the responsibility for the enforcement of the Seeds Act, ensuring uniformity of procedures and standards. It must keep in touch with the requirements of the State Governments and assist them both in regard to supply of seeds to meet urgent requirements and in hastening the adoption of new technologies in seeds. It should be the national authority for registration of varieties.

4.68. The Indian Council of Agricultural Research has already the function of guiding, co-ordinating and promoting agricultural research. It must pay special attention to the introduction of new varieties and to the strengthening of research and plant breeding and allied subjects. It should strengthen the co-ordinated research programmes on various crops and ensure adequate funds. It must undertake publication of type books illustrating the more important varieties and their specific characteristics. It must also lay down standard procedures for breeder seed production of each crop. It must allocate clear-cut responsibilities to different research stations for maintaining breeder stock of particular varieties.

4.69. The Indian Agricultural Research Institute has a seed testing laboratory affiliated to the International Seed Testing Association. It must provide leadership to the 17 seed testing laboratories in India and other laboratories that may be set up to ensure accuracy and uniformity of testing. The I.A.R.I. is also playing a useful role in various training courses. This would be an increasingly important function. A Seed Technology Division is being set up in the I.A.R.I. and it should be possible for this Institute to undertake specialised research projects on seed processing, seed storage and seed production. It must pay special attention to research in seed pathology and to investigations on vigour of seeds both of which are assuming greater importance than before.

4.70. The National Seeds Corporation functions mainly as a foundation seed agency but has also acted as a promoter of seed enterprise in India. It has set up processing plants and has helped various agencies to set up such plants. It has also undertaken certification services for hybrids. With the enforcement of the Seeds Act, the certification work will be transferred to the State Governments. The National Seeds Corporation will continue as the national foundation seed agency, though other foundation seed agencies may develop in States as the volume of seed required increases. The Corporation must set up a Technical Design-cum-Engineering Division to assist seed producers in resolving their problems of seed processing, and to develop good quality processing machinery within the country. It should act as a pre-release multiplication agency for all-India varieties. It has been providing training courses in the past and it should continue to function as such by providing over-all training for senior staff of the State Governments and other seed producers.

4.71. The State Governments have the major responsibility of drawing up the seed improvement programme within the State and in ensuring achievements according to the programme and the plan targets. At present, extension agencies are distributing a good part of the total seed requirements. It should be the objective to develop alternative sources of supply and relieving the Extension Agencies of the function of acting as distributors. The State Governments must set up certification agencies, strengthen their seed testing laboratories and take other necessary steps to implement the Seeds Act.

4.72. The agricultural universities have a special role to play in view of the technical know-how available in these universities. They should provide training at the State level and offer specialised courses in Seed Technology. They should participate effectively in the State seed certification programmes.

4.73. The co-operatives are in a position to make a significant contribution in the field of retail distribution. They can also play an important part in the development of seed production-cum-processing co-operatives. The National Co-operative Development Corporation has already drawn up a model scheme in this connection and it should be possible to organize a number of such societies.

4.74. Private enterprise has an important role in developing the seed industry. The seed industry is not reserved for the public sector and private investment in this field is feasible and desirable, as there is need for a number of agencies to effectively serve large number of farmers requiring seeds of various kinds.

4.75. There are also two associations of seed growers in India, namely, the India Crop Improvement and Certified Seeds Producers' Association and the All-India Vegetable Seed Growers' Merchants and Nurserymen Association. These Associations have important functions to discharge in the development of the seed industry. They should impose a certain measure of internal discipline on seedsmen and seed dealers. They should serve as forum of discussions of various problems of seed enterprise. They can provide many useful common services to all seedsmen.

4.76. The above roles are only broadly indicative of the possibilities. It would be neither necessary nor desirable to define the roles and functions of the different agencies in a rigid or static manner. As conditions change, new agencies will come into picture and the roles of existing agencies will undergo changes. To a large extent, the role of each agency will depend on the effectiveness of its performance.

4.77. At the same time, if every thing changed all the time, there can be no planning and orderly development. The Team, therefore, recommends that the Governments at the State as well as the Central levels should lay down clear-cut policies defining the roles of different agencies for a reasonable period of time in order to evaluate the results.

EXPORTS

4.78. Traditionally, there has been a limited volume of exports of seeds particularly of vegetables and flowers. Export of seeds of food grains has not been possible owing to the general foodgrain shortage and the inadequacy of seeds to meet requirements. The situation has, however, now changed considerably and the country is in a position to export seeds of various kinds. Owing to the various agro-climatic conditions in the country, we can produce practically every type of seed almost in any season. The availability of scientific personnel on the one hand and the methods of hand harvesting and frequent inspections made possible by the availability of large numbers of labour and semi-skilled persons on the other provide a competitive advantage to seed production.

4.79. The progress made, in seed-certification, seed testing and seed processing will provide the basis for the development of an export trade in quality seeds. There is an immediate need for a comprehensive survey of import needs of seeds of different countries, by volume and value. Varieties that would be suitable abroad should be evaluated through testing in foreign countries. Similarly popular and outstanding varieties grown abroad should be obtained and tested for seed production within the country. No seeds other than those confirming to minimum specified quality standards should be allowed to be exported. Further to develop export markets, proper drying and packing of seeds needs attention. The moisture content of seeds must be much lower to stand hot and humid conditions of storage and transport and to enable canning. Present restrictions on export of seeds must be removed and procedures simplified to enable quick movement of seed. Seed companies must be encouraged to specialise in export of seeds and specialised equipment for processing and packaging must be allowed to be imported. There is little doubt that a sizeable export trade could be built up with aggressive salesmanship. A special aspect of the export of seeds is the possibility of re-export of grass and clover seeds. Many countries get their seed requirements in respect of these seeds multiplied abroad. The Indian Grassland and Fodder Research Institute must immediately undertake studies in seed production of grasses and clovers currently popular in advanced countries by importing the seeds or producing them locally. The export possibilities are particularly good in respect of vegetable seeds in South East Asia, Middle East and African countries while hybrid maize seed is reported to do well in Malaysia and Ceylon. Hybrid sorghum has good possibilities in African countries while flower clover and grass seeds may have a market in the advanced European countries and in the U.S.A.

FOREIGN COLLABORATION

4.80. Overseas operations of U.S. companies are of two types :—

In one case the companies licence growers in other countries, where they feel it would not justify starting their own operations, to grow and sell within their countries the varieties bred by the companies. Before such an agreement is concluded, these varieties are evaluated in particular environment and only if yields are satisfactory, the companies enter into an agreement. The companies give, under the agreement, technical assistance in the areas of production, processing and distribution in return for a technical assistance fee, which is related to the volume of sales. In addition, a royalty is also claimed for the use of the trade mark. One company indicated that the scale of technical assistance fee in agreements of this nature is about 10 per cent of the net sales price. Where the companies are involved in actual operations, they join hands with a foreign partner generally retaining the majority control. Where the market volume and potential justify, breeding and research are also taken up in foreign countries. In such cases they train the local breeders in U. S. universities and with their own breeders. The guiding principles which the American companies follow in this type of operation can be summarised as under :—

(a) Joint ownership with a local firm, preferably with the controlling interest held by the American company ;

(b) Local management is developed by training in United States.

(c) A fair amount of autonomy to overseas companies in their operations

(d) Complete protection to their pedigrees and use of their trade mark.

(e) Royalty for technical assistance and know-how.

(f) Development of integrated companies with their own foundation seed programme and research.

4.81. In other countries also, particularly in the U.K., there is similar interest in collaborating with the developing countries. The question, therefore, arises if as a matter of policy, such collaborations should be encouraged. The Team is not in favour of foreign collaborations unless there is a significant contribution to our technical know-how. Three directions in which the foreign seed companies are considerably more advanced than Indian companies are (1) Research and breeding programmes (2) Processing techniques and (3) Marketing techniques. We would certainly benefit in all the three fields by foreign collaboration, but the chief attraction lies in the breeding and research programmes and the availability of breeding material. It is true that in the recent past there has been sizeable international exchange of breeding material but this is confined to material available with public agencies. We have already seen that considerable research is undertaken in the private sector especially

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required for certain specified plants and plant materials. Some diseased plants do not show any symptoms at the time of export but the disease may develop on the way and the symptoms may appear by the time of arrival in India. The Team is of the view that the existing facilities for plant quarantine are not adequate and fall short of requirements. This is an area which we consider needs immediate attention and strengthening. There are three aspects which require careful consideration :—

(1) There should be an effective educational programme so that all persons visiting abroad realize the importance of plant quarantine. An information sheet on plant quarantine should be furnished to every person going to a foreign country for guidance, so that he does not bring in unintentionally any plant material without requisite safeguards. A procedure for declaration of plant materials brought in, if any, would ensure effective plant quarantine measures.

(2) The existing arrangements under the Plant Protection Directorate for checking of imported seeds and their fumigation should be further strengthened by way of well trained staff and modern equipment to meet the needs of increasing import of plant material.

(3) Glass-house and other needed facilities should be established at the Indian Agricultural Research Institute and its other selected regional centres for observation of imported plant breeding material where considered necessary prior to their introduction.

(4) Procedures must be laid down regarding the types of materials to be tested and the aspects for which testing should be done.

4·85. Further, in the interest of speeding up agricultural production programmes bulk imports of seeds are sometimes arranged. Such imported seeds should be grown preferably at large State or Central Government farms under adequate technical observation and control.

4·86. The Team recommends that the measures listed above should be implemented on a *priority* basis to avoid the risk of spread of new diseases.

4.87. The introduction of the High-Yielding Varieties Programme in 1966 has imparted a new dynamism to our agriculture and the techniques of cultivation, the cropping patterns, the availability of inputs and water and many other factors are undergoing a rapid change. The Team has constantly kept in view the various trends in our agriculture and the changes that are likely to occur as far as they can be foreseen. But it must be recognised that we are passing through a revolutionary and transitional era in our agriculture and many of the recommendations made by us would be overtaken by further developments in the next five years. We therefore, recommend that a fresh appraisal of the seed programmes and policies must be undertaken within next five years.

TABLE II

Grade	Specification
MF (Medium flat)	.. Over 18/64 and through 22/64 round hole ; through 13/64 or 13½/64 slot screen
LF (Large flat)	.. Over 22/64 and through 26/64 round hole ; through 13/64 or 13½/64 slot screen
MR (Medium round)	.. Over 18/64 and through 22/64 round hole ; over 13/64 or 13½/64 slot screen
LR (Large round)	.. Over 22/64 and through 26/64 round hole ; over 13/64 or 13½/64 slot screen

CHAPTER—5

SUMMARY AND CONCLUSIONS

As already mentioned, in Chapter—3 of Part I, we have given a brief indication of the position in the foreign countries and in Chapter—4, we have given a summary report of our recommendations concerning the improvements to be effected in the Indian seed programme. The detailed suggestions for these recommendations and more comprehensive informative data on the position in India as well as abroad are provided in the relevant chapters of Part II. In this Chapter, we are providing in summary form, the conclusions and recommendations of the Team.

Registration and Release of Varieties

(1) The Team is not in favour of a compulsory system of screening of varieties before they are marked. The Team is of the view that the fear of exploitation as well as of risk of production from new varieties that are not officially released are rather exaggerated. The Team, therefore, recommends that the present procedure which allows freedom to market varieties without compulsory official screening be continued.

(2) It should be made compulsory by law either by an amendment of the seeds Act 1966 or by other means that no variety may be marketed unless it is indexed by an official agency. Such indexing or registration will be confined to ensure that the new variety is botanically distinct and will have characteristics that are constant. Testing for agronomic superiority is not a pre-condition for such registration.

(3) It is not necessary to have trials by an official agency before registering a variety for botanical distinctness. The claims made by a breeder may be accepted if the registering authority is satisfied.

(4) A Committee inclusive of scientists set up by the Government of India, should be the registering authority. A separate Research Institute for testing is not necessary.

(5) Varieties taken upon official programmes of agricultural production should ordinarily be those approved by either the Central or State Variety Release Committees. These Committees exist in most of the States in one name or another. The constitution of the Committees as well as the procedure for release may be streamlined on the recommended model to ensure complete co-ordination between research and extension agencies.

(6) The co-ordinated schemes of research being organized on an all-India basis provide for extensive trials at a number of research stations all over India. They do not, however, have any systematic arrangement for trials in farmers's fields. The Team agrees with the view that the release should be primarily based on the data from research stations. However, there are certain obvious advantages having trials in farmers' fields through extension agencies. These trials help to educate the farmers and seed growers and also extension personnel. They provide useful supplementary data for consideration by the variety release committee. It is recommended that the co-ordinated schemes should organize such trials simultaneously with trials in research stations. The trials on farmers' fields may be organised in the third or final year of testing just prior to release.

Period of Testing

(7) As regards the period of testing, three years testing should ordinarily be adequate. This can be three seasons in certain cases. Where a variety is outstanding, the period of testing should be cut down.

(8) Varieties of doubtful value should be descarded after three years of advance testing.

Variety Release Committees

(9) The Central Variety Release Committee should be made fully representative of all the different States by enlarging its membership to provide representation to all the States.

(10) The Central Variety Release Committee should be the authority for releasing all varieties evolved by the co-ordinated schemes on an all-India trial basis. The releases made by the Central Variety Release Committees may be placed before the State Variety Release Committees for information to provide an opportunity to the State Committees to record their opinion , if any.

(11) The Departments of Agriculture in different States as well as the Directorate of Extension at the Central level should continue to test and collect data on field performance of all varieties whether officially released or not and give wide publicity to the data so that farmers may have guidance in making their choice of varities.

Pre-release Multiplication

(12) Pre-release publicity regarding new varieties should be strictly avoided. Scientists and all others concerned must exercise adequate restraint in respect of new varieties and should not publicise the new variety until at least sufficient foundation seed stocks of the variety have been built up.

(13) To reduce the time-lag between evolving of a variety and its availability to farmers, pre-release multiplication should be taken up to increase both breeder and foundation seeds in respect of promising varieties.

Private Research

(14) In foreign countries, research by public agencies is supplemented to a large extent by research by private agencies. In india, there is not much research in plant breeding by private agencies. There is scope and need for developing this as private research has a special role in the selection of varieties, suited to specific local requirements. The Team recommendes the development of such research.

(15) Any person or institution desirous of taking up research work in plant breeding should be required to register himself/itself with the I.C.A.R. The I.C.A.R. should lay down standards for eligibility for such registration.

(16) A liberal policy should be adopted in the supply of breeding material to such registered agencies.

Breeders' Rights

(17) In the long run the breeders' rights system would be desirable, as a means of encouraging private research. This is necessary, as at present research in evolving new varieties is not entitled to patent rights under our patent laws. Immediately, however, it is not practicable or opportune to introduce a system of breeders' rights. We have elsewhere recommended a system of registration of varieties. When this system as well as private research have developed adequately it would be ipportune to consider a scheme for breeders' rights.

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(18) Arrangements for breeder seed production are unsatisfactory at present. It is readily assumed that just because seeds are supplied from research institutes they would necessarily pure. This will not be so unless research institutes have sufficient facilities and the breeders accept the responsibility for the supply of quality breeder seeds and pay special attention to the same. The Team recommends that the I.C.A.R. should lay down standard procedures for the production of breeder seeds. Facilities should be provided to research stations wherever necessary.

(19) Sufficient internal checks should be provided for, as in Sweden, for checking the purity of breeder seed. Supplied from research institute to ensure it is of sufficient purity.

(20) A large number of small farms have been established over the Five-Year Plans, for the production of foundation seeds. Many of these farms are not suitable for this purpose nor would it be economic to provide adequate facilities, or appoint staff of sufficient calibre. Inspection of these farms which are scattered in different blocks is also difficult. It is recommended that in the future foundation seed production should be taken up in adequately large-sized farms with adequate facilities and with good technical staff. With the availability of the cosmopolitan varieties, the importance of decentralisation of production in scattered farms has considerably diminished. At the large farms, specialist can be requested to inspect the foundation seed plots quite frequently as there would be only a few farms conveniently located.

(21) It was reported that in some states, the existing farms are being continued on a year-to-year basis, and that the funds provided are not sufficient. The existing farms should be put to the best possible use. They could be used for foundation seeds of local varieties or for other purposes. If the farms cannot

be put to proper use even after providing adequate facilities, there should be no hesitation to close them down. It is recommended that the State should take up immediately a detailed examination of the farms on these lines. The farms which are considered useful should be sanctioned on a permanent basis.

(22) There must be advance planning of foundation seeds. Such planning should provide for some surplus of foundation seeds. A reserve stock of foundation seeds must be maintained by the State Governments.

(23) The National Seeds Corporation should make full use of the facilities available at Agricultural Universities, State and Central Government farms for multiplication of foundation of seed.

(24) The National Seeds Corporation should continue as a national agency for production of foundation seeds for hybrids. Other specialised agencies with suitable facilities like agricultural universities may also be developed for the purpose. There should not ordinarily be more than one agency for a State. Co-ordination of foundation seed production amongst the various agencies would be necessary and may be brought about by the Government of India through a suitable co-ordinating committee.

(25) Foundation seed production of vegetable seeds should be effectively organized by advance planning and linking breeder and foundation seed to certified seed production. This may be done in consultation with vegetable seed organizations.

(26) A central reserve stock of foundation seeds of varieties of all-India importance should be built up by the National Seeds Corporation to ensure steady availability of foundation seed.

(27) Foundation seed should normally be produced in farms owned by Government or quasi-Government Institutions.

(28) Foundation seed farms should be well-developed by land-levelling along with irrigation and drainage facilities and should be supervised by qualified technical staff.

Certified Seed Production

(29) Organizations producing foundation seeds should adopt allocation policies for distribution of foundation seed based on past production records of certified seeds, and giving weightage to facility available with certified seed producers.

(30) Certified seed production should be in areas determined by natural advantages of different regions. Areas where good quality seed can be produced without risks of diseases, pests or failure should be preferred. There need not be self-sufficiency of seeds in each block. On an all-India basis, however, it should be possible for each State to become self-sufficient by locating suitable areas of production. The doctrine of self-sufficiency of seeds within each State should not, however, be carried to extremes and where there are advantages in arranging production in other States, the seed production should be organized in such States.

(31) Free inter-State movement of seeds should be allowed so that the best areas may ultimately come to specialise in seed production.

(32) The problem of isolation cannot be solved without recourse to some legislative action. If the powers under the Essential Commodities Act are not adequate, Government should not be hesitant to arm itself with legislative power to destroy any crop that may contaminate a seed crop.

(33) The Indian Council of Agricultural Research should initiate a co-ordinated scheme to determine isolation requirements appropriate for various crops in different potential seed production regions in the country.

(34) Seed production studies should form part of the co-ordinated research schemes on hybrids and vegetable crops.

(35)(a) Specialised planting equipment should be allowed to be imported for seed production of those kinds not available in the country.

(b) Dessicants be tested under our conditions and be allowed to be imported. If they prove popular the chemical companies be encouraged to manufacture them locally.

(c) Combine harvestors be allowed to be imported by seed companies, co-operatives and large farms to assure that the seed harvest can be completed in record time without loss of crop.

Seed Processing

(36) About 450 plants of 1,000 tons capacity each would be needed by 1972-73.

(37) There is an urgent need for a strong and well-staffed Engineering and Design Organization which should devote itself exclusively to the study of the problems of processing of different seeds, the types of equipment required, the specifications thereof, the problems of manufacture of such equipment and provision of requisite assistance and advice in this regard.

(38) The most appropriate agency for undertaking the above work on seed processing equipment and provision of assistance to seed producers and seed manufacturers would be the National Seeds Corporation which has already a cadre of engineers who have assisted in establishing various processing plants and have also experience with the batch type system of seed processing.

(39) One of the major limitations in the development of the demand is the doubt in the minds of the buyers in regard to the quality and reliability of the equipment that are locally made. If a Central agency undertook the responsibility of checking and ensuring quality, the demand for equipment may increase rapidly. Further, planning of production and manufacture of equipment can be done better if the orders for various equipment are consolidated and placed well in advance.

(40) The National Seeds Corporation which has the objective of development of seed industry in the country should act as a central agency for placing advance orders on selected firms for the manufacture of different kinds of seed processing equipment and should in turn supply these equipment to the seed industry.

(41) It would be extremely useful if the engineers in charge of the manufacture of seed processing equipment could be sent on a study tour to such firms in foreign countries. They should also visit institutions like the Mississippi Seed Technology Department where they could be given specialised training and orientation in the requirements of seed processing equipment.

(42) To meet the immediate deficiencies in seed cleaners, it is recommended that over the next few years import of seed cleaners may be allowed. Screens of different sizes and specifications should also be imported.

(43) Automatic control devices like thermostats and automatic re-ignition devices should be imported. The import of bag closers should also be allowed.

(44) The import of specialised types of seed processing equipment like specific gravity separators, aspirators, automatic weighing and bagging machines, cylinder separators, sizing equipment and special types of driers should be allowed as an experimental measure and the use of such machines should be encouraged.

(45) If Government are not entering the field of seed production and marketing except for foundation seed, it may confine the establishment of processing plants only to such areas where other agencies do not come forward to establish the same and even in such areas, the Government plants should be handed over as soon as another agency is ready to take over and operate them.

(46) Facilities should be developed for drying of seeds, if necessary down to 5 per cent moisture and their proper canning. This system should be adopted especially for foundation seeds and vegetables.

Seed Marketing

(47) Government should take appropriate measures for the development of seed enterprises working on commercial principles in competition to ensure the supply of high-quality seeds to the farmers at reasonable prices. To achieve this objective we recommend the following measures for stimulating the growth of a healthy and vigorous seed industry :—

(a) To reach the high goals set for the future, a massive expansion of seed producing and distributing units is called for. Government should, therefore, through a policy declaration earmarking a major role, encourage the development of co-operative and private seed processing, marketing and distribution organizations. As these organizations develop, the departmental agencies now engaged in the production, purchase and sale of seeds should reduce their activities in this direction.

(b) The departmental agencies should provide the general planning of the various programmes including fixation of targets and concentrate on extension of functions.

(c) Purchase prices to growers and sale prices to farmers should be left ordinarily to be regulated by market forces. Co-operatives and Government undertakings as well as Departments distributing seeds should so fix their prices as to cover all their costs and overheads, the risks and writes-off and provide a reasonable rate of return to the Exchequer. This is possible as by using high-quality seed, the farmer is able to get adequate returns. No subsidies or guarantees would be necessary in these circumstances.

(d) The promotion of medium-sized seed growers' production and marketing co-operatives should be actively encouraged in the initial stages through liberal financial assistance by National Co-operative Development Corporation to cover adequately the investment and working capital requirements for setting up seed production and processing units.

(e) It is gratifying to note that the budget for 1968-69 provides tax concessions on expenditure incurred by firms using agricultural produce as raw materials in assisting farmers to grow better crops. Suitable tax concessions should also be provided to seed organizations on the expenditure incurred by them in sales promotion of seeds and by provision of technical services. Such concessions should be available for an initial period of 5 years as this will encourage seed companies to undertake promotional work in rural areas.

(f) Inter-State movement of seeds which are certified and/or labelled in accordance with the provisions of the Seeds Act should be freely permitted.

Seeds Act and Quality Control

(48) The Seeds Act should be implemented in a manner as to be educative. To begin with, States may employ a limited number of inspectors, who are well qualified, mature and can be relied upon to inspect various seed lots, educate the seedsmen and generally enforce the Act without hampering the trade in seeds.

(49) The Chief Seed Inspector should be located near the seed testing laboratory as he must maintain close contact with the seed testing laboratory.

(50) The implementation of the Seeds Act should be generally in a phased manner. It is suggested that initially only the major varieties of some crops might be taken and that only in a few districts preferably in the Intensive Agricultural District Programme areas. Those kinds or varieties that have high value such as vegetables and hybrids should be included in the first instance.

(51) The records to be maintained by seedsmen as well as seed processors should be drawn up in detail and all seedsmen informed of the necessity of keeping such records.

Seed Certification

(52) Seed Certification agency should be independent from the agency producing or selling the seeds on the one hand and the agency enforcing the Seeds Act on the other.

(53) The Certification agency, in our opinion, should be set up as Boards constituted in different States. These Boards should be representative of seed growers, seed trade, scientists, agricultural universities, Department of Agricultures and the farmers.

(53) Central Seed Certification Committee should be constituted as a Sub-Committee of the Central Seed Committee envisaged under the Indian Seeds Act. The Central Seed Certification Committee should lay down basic standard procedures, policies and guide lines but will have no authority over the seeds certification agencies. The Central Seed Certification Committee should adopt the same approach as the O.E.C.D. adopts in respect of certification in different countries in the world to bring out the uniformity in procedures. The Central Seed Certification Committee would be the most appropriate agency in respect of O.E.C.D. certification.

(54) It is recommended that the Government grants be given to the certification Board in respect of buildings, equipment, vehicles and staff in the earlier stages with the stipulation that every certification agency would be self-supporting within a period of five years.

(55) The certification agency should lay down standards for processing plants, and give approval to those plants which comply with the standards. Seeds not processed at these plants should not be certified.

(56) Certification should apply only to those varieties which are finally recognised as equal or superior to existing varieties. In other words, only those varieties which are finally released by the State Variety Release Committee or the Central Variety Release Committee should be taken up for certification

(57) There is not sufficient ground for insisting by law that the farmer must purchase only certified seed.

(58) Suitable plots should be taken and placed under the control of the seed certification agencies where they can grow samples from different lots of foundation seeds and certified seeds against standard samples maintained by them in order to check the effectiveness of field inspection and to evaluate the quality of the seed being produced both in the foundation and certified seed class.

(59) Further work should be done for improving the present sealing arrangements though we were informed that the present sealing system serves the purpose.

(60) The certification trade mark should be registered under the Trade Marks Act so that if any malpractices are discovered, suitable legal proceedings could be instituted.

(61) Immediate steps be taken to assure that the seed testing programme does keep pace and properly supports the seed industry and the seed improvement programme.

(62) The main additional facilities needed in most laboratories are cooling systems to be used with existing germinators and walk-in room germinators which are temperature-controlled at the prescribed temperatures.

(63) Methods of germination for new species need to be investigated.

(64) The Forest Research Institute, Dehra Dun has taken steps to indigenously manufacture suitable germination paper. This programme should be given high priority and the Institute should supply the needed paper through its pilot plant until commercial production is feasible.

(65) Testing procedures, reports, registers and working cards should be standardised throughout the country.

(66) More adequate space to assure safe storage of seeds for at least 12 months is needed in most laboratories.

(67) The Central Seed Testing Laboratory at I.A.R.I. should be encouraged and staffed to provide adequate coordination and leadership to laboratories throughout the country. Only one Seed Testing Laboratory should be developed in each State and it can be fully equipped and staffed with well-trained personnel. There should be promotional opportunities in the field of seed testing to retain trained staff.

Training

(68) The Central Government should assume responsibility for training in those areas where common procedures and techniques are needed throughout the country and where a relatively small number of highly trained and competent persons are needed.

(69) Training of personnel at the State level ranging from 1 to 3 weeks should be organized.

(70) Seed Producers' Associations should be encouraged to assume greater responsibility in training and educating their members.

(71) The Indian Agricultural Research Institute should establish the Seed Technology Division at an early stage and assume responsibility for providing training programmes.

(72) India Crop Improvement and Certified Seed Producers' Association and the All-India Seed Growers, Merchants and Nurserymen Association develop a programme in co-operation with the Government for a systematic training of their Associations' leaders who would be in a position to share their experiences and knowledge with members of the respective Associations.

Role of various agencies

(73) Planning on a national scale, guidance and coordination with the Central Government are vital for progress of seed improvement in different States.

Central Government must :—

(i) ensure uniform standards and procedures in the enforcement of the Seeds Act and seed certification ;

(ii) maintain sufficient research and testing facilities on a national scale ;

(iii) keep in touch with the requirements of State Governments and assist them in seed supply and in hastening the adoption of new technologies ;

(iv) function as a national authority for registration of varieties ;

(v) provide financial assistance to States to develop their seed programmes in accordance with the national policies.

(74) The Indian Council of Agricultural Research should strengthen the coordinated research programmes of various crops, pay special attention to introduction of new varieties and promotion of research among private agencies. It should organize storage facilities for genetic stocks and make breeding material available to the public as well as private research agencies.

(75) I.C.A.R. should publish type books, illustrating the more important varieties in their characteristics.

(76) The I.C.A.R. has special responsibility of breeder seed production for which it must lay down standard procedures for each crop. It must also allocate clear-cut responsibilities to different research stations for maintenance of breeder stock of particular varieties.

(76) The Indian Agricultural Research Institute must establish the Seed Technology Division at an early date. It must undertake studies on maintenance of viability and vigour in seeds under different conditions and the most appropriate methods of storage, harvesting, processing, etc.

(77) The Seed Testing Laboratory of the I.A.R.I. must introduce a system of referee testing to ensure uniformity of seed testing in all the laboratories in India. It must provide active leadership in developing the 17 State Seed Testing Laboratories.

(78) The I.A.R.I. must organize training courses in collaboration with the National Seeds Corporation who in turn can train staff at the State level.

(79) The National Seeds Corporation must assist the State Governments in setting up certification agencies and making an orderly transfer of work of certification to these agencies. It should function as a major source of foundation seed not only in respect of hybrids, but also in respect of other varieties of all-India importance and must undertake pre-release multiplication of foundation seeds of varieties evolved under the all-India co-ordinated schemes. It must serve as source of technical information and guidance in all matters pertaining to seeds. It must also provide training facilities in seed production, processing and certification. It must undertake commercial operations in the field of vegetables, fodder seeds and commercial crops. It should provide consultancy services in the field of seed processing and encourage manufacture of seed processing equipment within the country.

(80) The State Governments have the major responsibility in drawing up seed improvement programmes and in ensuring the achievement of plan targets. They have to enforce the Seeds Act, 1966 and set up independent seed certification agencies. They must encourage the growth of seed enterprise in private and co-operative sectors and to the extent there is a gap in seed supply, they must be prepared to strengthen procurement and distribution of seeds.

(81) The State Governments have special role to play in the field of extension work. New varieties require new cultural practices and the benefits must reach the farmers.

(82) Agricultural universities have an important role to play in research, breeder seed production and in foundation seed production on behalf of the foundation seed agencies. They should also have specialised courses in Seed Technology leading to a degree and participating effectively in State certification agencies programmes.

(83) Co-operatives can make significant contribution in the field of retail distribution. They can also undertake production processing and marketing of seeds on the wholesale level. Specialised co-operatives can be developed on the basis of a model scheme developed by the National Co-operative Development Corporation.

(84) The private sector has a large scope and opportunity for developing modern seed companies undertaking distribution through commercial channels to farmers.

(85) Seed Growers', Producers' and Dealers' Associations have an important and educative role to play. They must also enforce internal discipline among seed dealers and seed growers to ensure that the farmers are enabled to obtain quality seed.

(86) The States and Central Governments must lay down clear-cut policies defining the roles of different agencies and such policies should be reasonable, firm and operative for a sufficient period of time.

(87) Commercial banks should be encouraged to extend an increased volume of credit to cover long-term and short-term requirements of finance. The Team endorses the proposal of the Fertiliser Credit Committee for the formation of a Fertiliser Credit Guarantee Corporation. Seeds are vital agricultural inputs and hence should be covered by this scheme.

(88) The Reserve Bank should make it clear to commercial banks that all seeds, raw or processed, certified or non-certified, whether produced on contract with State Governments or National Seeds Corporation or not, should be treated as agricultural input and not as grain for purposes of advance. We also recommend that steps be taken to guarantee advances made to seed producers and that this be included in the scope of activities of the Fertiliser Credit Guarantee Corporation proposed by the Venkatappiah Committee.

Plant Quarantine

(89) There should be an effective educational programme so that all persons visiting abroad realise the importance of plant quarantine. An information-sheet on plant quarantine should be furnished to every person going to a foreign country for guidance, so that he does not bring unintentionally any plant material without requisite safeguards. A procedure for declaration of plant materials brought in, if any, would ensure effective plant quarantine measures.

(90) The existing arrangements under the Plant Protection Directorate for checking of imported seeds and their fumigation should be further strengthened by way of well-trained staff and modern equipment to meet the needs of increasing import of plant material.

(91) Glass-house and other needed facilities should be established at the Indian Agricultural Research Institute and its other selected regional centres for observation of imported plant breeding material where considered necessary prior to their introduction.

(92) Procedures must be laid down regarding the types of materials to be tested and the aspects for which testing should be done.

Exports

(93) There is an immediate need for a comprehensive survey of import needs of seeds of different countries, by volume and value.

(94) Varieties that would be suitable abroad should be evaluated through testing in foreign countries. Similarly popular and outstanding varieties grown abroad should be obtained and tested for seed production within the country.

(95) No seeds other than those conforming to minimum specified quality standards should be allowed to be exported.

(96) To develop export markets proper drying and packing of seeds needs attention. The moisture content of seeds must be much lower to stand hot and humid conditions of storage and transport and to enable canning.

(97) Present restrictions on export of seeds must be removed and procedures simplified to enable quick movement of seeds.

(98) Seed companies must be encouraged to specialise in export of seeds and specialised equipment for processing, and packaging must be allowed to be imported.

(99) The Indian Grassland and Fodder Research Institute must immediately undertake studies in seed production of grasses and clovers currently popular in advanced countries by importing the seeds or producing them locally.

Foreign Collaboration

(100) The Team is of the opinion that foreign collaboration with advanced countries would benefit (i) research in breeding programmes ; (ii) processing techniques ; and (iii) marketing techniques. But the main attraction would be in the breeding and research programmes and the availability of breeding material. In certain crops where private research is very strong in foreign countries, foreign collaboration would be particularly useful. The terms of agreement should be liberal enough to attract foreign seed companies.

(101) Manufacturing units should be set up in collaboration with foreign concerns for processing and storage equipment to avoid imports of such equipment. Such collaboration would be required only in respect of specialised items like seed cleaners (large models), specific gravity separators, bag closers, dehumidifiers etc.

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In the present Study, the Team received valuable assistance from many quarters. The Team had the opportunity to study in detail various aspects of seed industry in Sweden, the Netherlands, the United Kingdom, the United States of America, Japan and the Philippines, thanks to the well thought-out and carefully prepared itinerary and the arrangements made by Mr. Johnson Douglas and Professor A.S. Carter of the Rockefeller Foundation. To the many institutions, organizations and individuals in the various countries visited who had given facilities for our visiting them and holding discussions we express our thanks. The Team had also the benefit of meeting Dr. J. George Harrar, President, Dr. Sterling Wortman, Director, Agricultural Sciences, and Dr. Ralph W. Cummings, Associate Director, Agricultural Sciences, of the Rockefeller Foundation in New York. We are also grateful to Dr. A.F. Schoorel who both in his capacity as the Director, Government Seed Testing Station, Wageningen, and as the Honorary Secretary and Treasurer of the International Seed Testing Association, assisted us with many useful discussions. Discussions with them were of special value. Our special thanks are due to Shri B. Sivaraman, Secretary to the Government of India, Ministry of Agriculture, for the opportunity given to the Team for a full and frank discussion on different aspects of seed industry. The Ministry of Food and Agriculture and the National Seeds Corporation helped us in a liberal measure with their personnel and facilities and by providing voluminous and varied information. The various governments in the States we visited had made excellent arrangements survey of the work actually being done in the field. The Development Commissioners, the Agricultural for a Secretaries of the State Governments, the Directors of Agriculture, Directors of Research Institutes and the staff of Agricultural Universities gave a good part of their time to discuss with the Team various issues as they impinged on various issues. The team is also thankful to the farmers, seed growers, co-operators and representatives of seed processing industry all of whom contributed materially to the work of the Team. Special mention must be made of the Indian Council of Agricultural Research, the Indian Agricultural Research Institute, the Agricultural Universities of Punjab, Mysore, U.P. and Andhra Pradesh with whom the Team had discussions. The Team had also the privilege of discussing the more important questions of public policy with the Union Minister of Food and Agriculture, the Chief Minister of Maharashtra, the Agricultural Ministers of Jammu and Kashmir, Mysore, Andhra Pradesh and Madras. The Team is grateful to them for the same.

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The staff of the National Seeds Corporation who had provided the secretarial assistance for the Team had laboured hard in the preparation of the Report and we would like to convey our thanks.

In conclusion we would like to place on record our appreciation of the contributions made by the Experts of the Rockefeller Foundation, the Ford Foundation, the USAID, FAO and the World Bank. Special mention has to be made of Dr. G.B. Baird and other staff members of the Rockefeller Foundation for providing us with a wealth of information derived not only from their experience in the developed and various developing countries but also based on the direct experience of the seed development work in the country. We also benefited greatly by the expert advice provided by the foreign consultants, i.e., (1) Prof. A.S. Carter ; (2) Dr. Walter Scott ; and (3) Mr. Clare Porter whose visit was arranged by the Rockefeller Foundation. Our thanks are due to these Experts who have given their evaluation of the situation in the country and given many concrete proposals which were of great assistance to the Team though the Team could not agree with them in all respects.

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I. J. NAIDU—Leader.
H. R. ARAKERI—Member.
R. L. PALIWAL—Member.
ANAND SAWANT—Member.
B. R. BARWALE—Member.
C. G. RAMANATHAN—Member.
J. VEERARAGHAVAN—Member-Secretary.

New Delhi :

Dated 14th June, 1968.

VOLUME II

PART II

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CHAPTER—6

REGISTRATION AND RELEASE OF VARIETIES

6.1. The major technological change occurring in Indian Agriculture in recent times is the steady availability of new and still newer varieties and hybrids highly responsive to fertilizers and having other desirable characteristics. Agriculture can no longer be static and a continuous increase in per acre yields of different crops is a necessary precondition for the stability and growth of the economy. There is need for continuous introduction of superior varieties in the years to come. Our agricultural research is now poised in this direction. Genetic material and germ plasms which form the building blocks of crop improvement are available as never before. The Indian Council of Agricultural Research has been strengthened and streamlined and given new direction and purpose. The agricultural universities and State Governments as well as Central Research Institutes are embarking on major research programmes. There is a well trained cadre of agricultural scientists working at all levels in all parts of the country for plant improvement. Close contact is also being maintained with the progress in plant breeding in foreign countries. A cross fertilisation of ideas across the world is giving a new vigour to research. As an instance, it may be pointed out that the discovery of the opaque gene in Purdue University is leading to vigorous efforts in every country to incorporate the same and produce high lysinecorn.

6.2. The introduction in India of dwarf wheat material from Mexico and of dwarf indica varieties of paddy has given new outstanding wheat and paddy varieties. The development of composites in maize has taken place and is being tried. The material made available through composites to breeders is likely to result in even superior and better hybrids than those currently available. Outstanding varieties in castor, pulses, oil seeds, jute, fodder crops and vegetables are expected to be developed.

6.3. Further, the beginnings of research by private organizations and foundations have already been made in India. Hitherto, there have been only a few foundations founctioning on a no-profit basis like the Maharashtra Association for the Cultivation of Sciences, the Allahabad Agricultural Institute, Naini, the Vivekananda Laboratory, Almora, the Institute of Agriculture, Anand and other such institutions have been taking part in agricultural research. Recently, the Birla Institute of Scientific Research has started showing interest in this direction. The Agricultural Association, Punjab, a private company is a joint Indo-American endeavour. The American partner of this Company—the DEKALB Agricultural Association—has a vast research organization with scientists located in different regions of the world exploring possibilities for further improvement in varieties. The DEKALB have been among the pioneers in the introduction of hybrid maize, hybrid sorghum and hybrid chicken and are currently attempting a breakthrough in hybrid wheat. The Maharashtra Hybrid Seeds Corporation, a private firm organized by progressive famers near Jalna, Nimbkar Seed Corporation and Annapurna Seed Farm Industry near Amaravati have on their staff scientific personnel who are engaged in research. There are already a number of vegetable dealers who have been functioning for a long time, and some of these may patent new varieties. It is also likely that varieties evolved abroad in other countries might prove superior in certain cases and if so, the stocks of such varieties are likely to be imported for further multiplication in India.

6.4. When new varieties are offered for cultivation, farmers have a hard choice to make. The new varieties offer the prospect of higher yields and higher incomes, but the farmer has to deal with a variety with which he is not familiar and he might commit mistakes. Further, if the variety does not have all the qualities claimed for it or is not adapted to the region, there might be total crop failure or outbreak of diseases, etc. If too many new introductions fail to fulfil the expectations of farmers, there might develop a general cynicism or resistance towards new varieties. The question, therefore, arises if there should be complete freedom for anyone to offer any variety one thinks best or if there should be some regulation and control—legal or otherwise—on the varieties offered for cultivation. In other words, the issue is if we can rely on the natural self-interest of the farmer as expressed in the buyers' choice or if the farmer's interests and the interests of crop-production need to be protected by certain regulatory measures.

POSITION IN FOREIGN COUNTRIES

6.5. The practices adopted in various countries differ widely in this regard. In the U.S.A., there is hardly any regulation of trade's freedom to offer varieties they think best, except that they must label the seed and give the correct name of the variety. Agricultural universities, research institutions, private firms etc., have, however, their own screening committees who consider research data and appraise a variety before offering it for sale to the public. In Sweden, on the other hand, no variety may be sold (in respect of most crops) to the public unless it is officially released, i.e. unless the representative committee constituted by the Government appraises the new variety and "releases" the same as fit for cultivation by farmers. In the Netherlands also the position was the same until recently, but the Act of 1967 has changed the situation. The Act of 1967 gives effect to the Paris Convention on the protection of breeders' rights and the directions of the European Economic Community in this regard. Under this Act, and in the United Kingdom as well, the position obtaining is intermediate between the total freedom in the U.S.A. and complete regulation in Sweden as new varieties are required to be registered with the Public Agency (usually a Plant Variety Registration Office) and once so registered, they may be offered for sale to the public. The registration is done after checking that a new variety is really different from existing varieties in genetic and botanical aspects. The question whether a new variety is superior in respect of agronomic characteristics is not gone into at the time of registration or "indexing" as it is called in the U.K. The main objective of registration is botanical distinctness and there is no recommendation or implication in the registration that the variety is economically superior. There is thus no insistence in the U.K. or the Netherlands that a new variety must be officially screened and judged superior before it is sold to the public, i.e., there is no instance on official "release" of varieties. In Japan in respect of vegetables eeds, there is a system of registration of varieties after checking the genetic distinctness of varieties. But unlike the U.K. and the Netherlands where registration is compulsory by law, in Japan registration is optional. Those who register a variety are entitled to breeders' rights and those who do not register cannot claim such rights.

OPINION ABROAD

6.6. The Team found wide divergence of opinion amongst scientists, government officials and tradesmen as regards the desirability and necessity of registration and release. In the U.S.A., in particular, there is a large body of opinion in favour of not having either registration or release on a compulsory basis. It was argued that the farmer, who has to ultimately use the seeds is the judge of what he wants, and any attempt to restrict or regulate his choice was not justified and led to needless delays. On the other hand, some officials in the U.S.A. pointed out that there was a wide proliferation of varieties and sometimes the same variety appeared in different names. This led to confusion which could be avoided only if registration was made compulsory. A view was expressed that for countries which are newly starting intensive research and release of varieties, it would be missing a great opportunity to put matters on a systematic basis if they do not introduce compulsory registration. On the other hand, it was also pointed out that some varieties cannot be easily distinguished from others and genetic distinctness may not be clearly established, yet the variety may be a new, useful selection. It was felt that any system for registration on compulsory basis would be expensive, indeterminate and time-consuming.

POSITION IN INDIA

6.7. In India at present there are no legal restrictions on varieties that may be sold to farmers. The only exceptions are as under :—

(a) Under the Cotton Control Acts of the Government of Gujarat, Maharashtra and Mysore, in certain specified areas, growing varieties other than specified ones is prohibited. The objective is to ensure freedom from mixtures which affects quality of cotton.

(b) Under the Jammu and Kashmir Vegetable Seed Act, only certain varieties of crops can be grown in certain areas. The objective of this Act is to ensure quality of vegetable seeds.

(c) A similar law bans the cultivation of disease susceptible sugarcane varieties particularly of redrot susceptible ones in U.P. and Bihar.

6.8. It will be seen that neither of the exceptions referred to above has regulation of varieties to be grown as their objective. The regulation is as consequency of their main objectives namely to protect the purity of cotton or seed as the case may be. This position has not been materially altered even after passage of the Indian Seeds Act, 1966. Under this Act, the Government of India may by notification require that certain kinds and varieties should be sold in containers and the containers must have labels declaring *interalia* the name of the variety. The trader is responsible for declaring the correct name of the variety. The Act does not go further than this.

6.9. While the legal position is described in the preceding paras, most of the research in plant breeding is in the hands of public agencies and in a sense the need for regulation by law had not arisen thus far. The public research agencies are bound by internal discipline and subject themselves to procedures for "official release" of varieties developed by various States over the years. The All-India Co-ordinated Schemes have also developed their own procedures for release of varieties. Central and State Variety Release Committees exist though these are known under different names in different States. The position obtaining in some of the States is briefly summarised in Appendix 'V'.

6.10. The question arises if the present position in India should continue or if a compulsory or optional system of release or registration of varieties should be introduced. As in the developed countries so in India, a wide divergence of opinion obtains. A number of State Governments and officials of the State Departments of Agriculture as well as scientists are in favour of a system whereby all varieties would be compulsorily screened by an official committee.

6.11. The arguments put forward in support of such a view were briefly as under :—

(a) If unrestricted freedom to market varieties were allowed, unsuitable and unadapted varieties might be sold under high pressure of publicity. This will result in exploitation of farmers and cause losses to them.

(b) Some of these varieties might be highly susceptible to new diseases and pests and might help the spread of pathogens or pests which might later attack even existing crops.

(c) The factors pointed out at (a) and (b) above might undermine the confidence of farmers and make them reluctant to adopt new varieties speedily.

(d) A large number of varieties would cause confusion and if the same variety should be sold under different names the confusion would be worse confounded. The farmers may not then be able to choose what is best for them.

(e) The extension agencies will also be unable to advise the farmers correctly in respect of many new varieties. This would apply both to the choice of varieties and in respect of cultural practices required to get the best out of the varieties.

(f) The risks involved in (b) to (e) above could perhaps be taken in respect of vegetable crops, but it would be inconceivable to take such risks in respect of food crops, at any rate in the present juncture.

6.12. As against these considerations, it was urged by quite a few officials, scientists and seedsmen that :—

(a) Compulsory official screening of varieties will delay the results of research reaching the farmer and slow down agricultural progress.

(b) Besides it will be a disincentive to (i) private research (ii) foreign collaborations both of which would be built up only if an early pay off for investment can be expected.

(c) The judgement of an official committee, howsoever eminent and widely represented, may not be superior to the market mechanism where the interested parties viz., the farmers continuously and immediately exercise their judgement on the varieties. The exercise of such judgement will lead to market-oriented research as in other industries.

(d) Compulsory official screening of varieties would in practice restrict the number of varieties and the choice open to farmers. In a large country with diversified agro-climatic regions and many local and regional problems and preferences a number of varieties offered on the basis of local experimentation and assessment of farmers' needs by different individuals would provide a better probability of rapid progress.

(e) The fear that farmers would be exploited does not take into account the fact that whatever high-pressure publicity may be employed, the farmers will not take to new varieties blindly. In the beginning, only a few farmers—who are well off and progressive—will experiment with a variety and that too on a limited scale. Only on the basis of its success and suitability can a variety spread to a larger area, especially as a new variety will not have official support.

(f) Extension agencies who would be in touch with whatever was happening could educate the farmers on merits and demerits of varieties.

(g) The risk of new diseases and pests is often exaggerated. It must be recognized that with many new varieties with higher levels of fertilisation plant protection measures become a necessity. Quite often a particular disease or pest tolerance may be sacrificed in the selection of a variety in favour of other desired qualities like yield potential. It is undeniable that modern agriculture needs plant potection.

Occasionally there might be a variety that is highly susceptible to a dangerous pathogen and might thus assist in the spread of the pathogen. But the movement of such varieties could be restricted under the Destructive Insects and Pests Act and if necessary the Act could be amended to provide the State with necessary power. It would be unreasonable to restrict the free sale of varieties for fear of an odd chance of a pest or disease outbreak.

(h) A sudden large spread of a variety is possible only under an official programme and when a variety is outstandingly superior. For official programmes, a screening by a representative committee could be provided for without infringing on the farmer's freedom to buy whatever variety he wants.

6.13. A careful consideration of the views expressed in favour of and against compulsory screening of varieties reveals that the issue centres squarely on the farmer's ability to choose appropriate varieties and the need for safeguards in this connection. In the Team's opinion, the farmer in India at the present stage cannot be left to his own resources in the selection of varieties. He does require certain safeguards and some measures of guidance. He must be assured that the seed he buys is truly the variety it is claimed to be. He must know the correct variety name and the cultural practices that go with it. The same variety should not be sold to him under different names. The Team does not think it necessary to go beyond these safeguards to restrict the trader's freedom and farmer's choice. There are already many rules, regulations and restrictions and our effort at this stage should be to implement these effectively and in proper spirit rather than add to the restrictions unless public interest clearly and imperatively requires the same.

6.14. The Team is not convinced of the risks to production or to farmer's confidence arising from the lack of compulsory screening before release of varieties. Irrespective of whether there is compulsory screening or not, a certain measure of risk is involved in any new technology and the risk is limited since the spread would necessarily be slow and gradual in the beginning. The Team recommends that the present procedure which allows freedom to market varieties without compulsory official screening be continued. The answer to the fear of exploitation of farmers is an effective extension agency and not the restriction of varieties available for sale. The Team recommends that the extension agencies of the State Departments of Agriculture as well as of agricultural universities must conduct trials on all new varieties whether officially released or not and adequately publicise the results of such trials. The extension agencies have a vital role not only in helping the farmer to choose the best available variety but also in helping him to obtain the best out of the variety. Further, we have recommended in Chapter 10 that certification be confined to officially approved varieties.

FURTHER SAFEGUARDS

6.15. As pointed out earlier, the farmer has the right to know the correct name of the variety of the seed he is buying. The Seeds Act, 1966, provides that when a kind or variety may be notified by the Central Government in the official gazette the kind or variety may be sold only in containers which are properly labelled. The Government would in such cases also notify the particulars which such label may contain. The Team recommends that the labels should be required to contain a declaration of the variety though for certain kinds of seeds it may be sufficient to declare "variety not specified". The Team is aware that the Seeds Act does not apply to sale or exchange of seed between farmers but in such cases it is presumed that the farmers clearly know the variety they are buying or exchanging.

6.16. The declaration of the variety on the labels will not be meaningful unless the variety is known by the same name. It is not unusual not only in India but in other countries also, for the same variety to be known under different names. It is reported that 2640 names were used in 1940 in the U.S.A. for 600 varieties of wheat, oats, barley and rye and 100 and odd names were used for one of the first successful corn hybrids. The American Society of Agronomy and the U.S. Department of Agriculture initiated in 1922 a voluntary system of registration of varieties of wheat, oats and barley. The registered names and descriptions were published in the journal of the Society. Varieties of soy bean, flax and other kinds were added later but many varieties were not registered. A similar effort was made to standardise the variety names of vegetables through publication of "type books" but these were again restricted to a small number of varieties in commerce. It is reported that to keep informed of the characteristics and names of varieties in commerce one had to read publications of the Department of Agriculture, State Agricultural Experiment Stations, seedsmen and private plant breeders. The publications had sometimes conflicting information. Most of the State Seed Laws in the U.S.A. recognise the problem of different names for varieties by providing that seeds be labelled to show the commonly accepted varietal name or only the name of the kind. An amendment to the Federal Seed Act in 1956 was sought to regulate the naming of varieties on labels of seeds entering inter-State commerce.

6.17. Unlike in the U.S.A., in most of the European countries the problem of different names for the same variety has been sought to be resolved by requiring compulsory registration of varieties.

6.18. The position in India today is that there are a number of varieties, many of which may have the same characteristics. There is no compulsory registration of varieties. The Indian Council of Agricultural Research had some time back initiated a voluntary scheme for registration by opening a "National Register of Varieties". This register is far from complete. The need for avoiding confusion in names of varieties is paramount and this is recognised universally. When a farmer buys a "variety" of seed, he buys certain characteristics of the variety and he inevitably compares these with other varieties he has grown. It is imperative that he must clearly know the correct names of different varieties he is buying.

6.19. The Team, therefore, recommends a scheme of compulsory registration of varieties. It must be provided by law, either by amendment of the Seeds Act, 1966, or by other means, that no variety may be marketed unless it is indexed or registered and a variety so registered must be sold only in the registered name. It has been urged that such a proposal would be—

(a) impractical, because it is not always possible to establish beyond doubt that one variety is the same as or different from another as there may be many useful selections with similar characteristics ;

(b) expensive, because adequate arrangements have to be made for testing the uniqueness or otherwise of varieties ; and

(c) time-consuming, as such tests are bound to be prolonged.

6.20. The Team recognises that there would be many practical problems in determining varietal characteristics in establishing varietal uniqueness. A certain measure of improvement may be permissible within the same variety. The question is essentially a scientific one to be determined in each case by the study of detailed characteristics. The problem is most difficult in respect of vegetables ; yet this has not deterred the Netherlands with its internationally known vegetable seed industry from introducing compulsory registration. There should be no insuperable difficulty in establishing whether a variety is distinct and homogeneous though there might be difference of opinion in a few cases.

6.21. In the U.K. and in the Netherlands the task of testing of varieties is entrusted to the National Institute of Agricultural Botany and IVRO respectively. Neither of these institutions is engaged in research in evolving varieties. An independent evaluation of varieties evolved by various research institutions is thus facilitated.

6.22. The Team, however, does not think it necessary to establish a separate institute in India in the near future for this purpose. A committee which should include scientists constituted by the Government of India would be the most appropriate authority for registering varieties, after ascertaining that they are distinct and homogeneous. In most cases it should be possible to rely on the data furnished by the applicants for registration. In case the registration committee feels that it is desirable to test the claims regarding the distinctness of the variety by actually growing the varieties they can make use of the facilities available at Central and State Research Institutes as well as with agricultural universities.

VARIETY RELEASE COMMITTEES

6.23. We have already pointed out that Variety Release Committees exist in different States under different names. Detailed procedures have been evolved over the years for assessing the superiority of varieties and their release. These procedures differ from State to State but include a preliminary evaluation by scientists and research workers on the basis of one or two years' trials in experiment stations and a subsequent assessment by a broad-based committee consisting of representatives of the Director of Agriculture, extension workers as well as research workers, which takes into account results on experiment stations as well as the results on farmers' fields before deciding to release a variety. Under the All-India Coordinated Schemes of research, in which a number of research institutes belonging to the Central and State Governments and agricultural universities participate, co-ordinated trials are organized at different centres in India and are evaluated by a workshop of scientists. On the basis of the recommendations of the workshop the co-ordinator places a proposal for release before the Central Variety Release Committee.

6.24. In the opinion of the Team the Central and State Variety Release Committees have been discharging a useful function. Varieties taken up in official programmes of the Central and State Governments should ordinarily be those approved either by the State Variety Release Committee or the Central Variety Release Committee. Among the various procedures in the different States the Team commends the procedure adopted in Punjab. Under this procedure promising strains evolved at research stations are first tested in the yield trials conducted at various research stations. A Variety Evaluation Committee consisting of scientists of all related disciplines approves the variety for further trials in the field. If the variety is approved by the Variety Evaluation Committee, the extension staff of the Department of Agriculture undertake trials simultaneously for two years in farmers' fields. The data from these trials are examined by the State Variety Release Committee, which recommends or rejects the variety.

6.25. The Team recommends that the various State Governments etc., may examine the constitution and procedure for testing and release of varieties in their respective States and consider suitable modifications in the light of the procedure outlined above though in respect of period of testing a flexible approach may be adopted as recommended in para 6.30. In the States where agricultural universities do not exist, the Evaluation Committee may comprise mostly of research officers headed by the Joint Director of Research.

CENTRAL VARIETY RELEASE COMMITTEE

6.26. We may now consider the functions of the Central Variety Release Committee and its relationship with the State Variety Release Committees. As each State Variety Release Committee releases varieties in respect of the areas comprising the State, it might appear that the Central Variety Release Committee has no particular function of release. However, in practice there is considerable advantage if the Central Committee functions as an all-India clearing house for releasing varieties on an all-India basis or inter-State basis. For example, under the all-India co-ordinated schemes trials are conducted in many different States and the results from these trials are considered at a workshop of scientists in which all the concerned States participate. The recommendations of this workshop along with the proposal for release of a variety are placed before the Central Variety Release Committee. These proposals indicate the areas in which a new variety would be adapted and could be recommended. In such cases the Central Variety Release Committee would release the variety for the different States. There is no particular advantage in transmitting the Central Variety Release Committee's recommendations to each State Committee for further release as no additional data would be available with the State Committees for further scrutiny. In order to keep the State Release Committees fully informed, the decisions taken by the Central Variety Release Committee in respect of all-India or inter-State release may be communicated to them. This would provide an opportunity for the State Release Committees to review the position in respect of the State.

6.27. In addition, it should be one of the functions of the Central Variety Release Committee to consider standard procedure for the variety release and to make recommendations in this regard to the State and Central Governments. The Central Variety Release Committee should also be charged with the responsibility of recommending varieties to the Central Government for purposes of any special agricultural production programmes which the Central Government may take up on an all-India or inter-State basis.

6.28. In order to effectively perform the various functions entrusted to the Variety Release Committees it should have a much wider representation than at present. As we envisage, the Central Variety Release Committee has to speak for all the States in India and it would be appropriate to provide for representation to all the States. At present this representation is provided on the basis of rotation. The number of meetings that the Central Variety Release Committee would be required to hold in a year should not exceed three or four and it should not, therefore, be difficult to provide the comprehensive representation.

6.29. At present Co-ordinated Research Schemes' releases are made based on trials conducted at research stations. It is recommended that as suggested by us for State Variety Release Committee procedures, trials may be organized in farmers' fields through extension agencies. Such trials would be of benefit to extension personnel and seedsmen in familiarising themselves with the new varieties under trial and also provide useful data for evaluation of the varieties. These trials may be conducted simultaneously with the third year of research trials.

PERIOD OF TESTING

6.30. The term 'variety release' implies an evaluation of varieties evolved by research work for all the qualities and a formal release recommending its cultivation by farmers. This means that before a variety can be released there should be adequate testing in order that the characteristics of the variety, the cultural practices to be adopted, the advantages and disadvantages and risks in growing the variety may all be evaluated under different agro-climatic conditions. There had been a general feeling on the part of many progressive farmers and private seedsmen that there is inordinate delay in the testing and release of new varieties. Some expressed the view that the Departments of Agriculture generally released a variety only after it is already extensively grown by farmers. On the other hand, there was an opinion that varieties should not be hastily released without testing for all aspects like disease resistance, consistency, adaptability and desirable cultural practices. After considering different views expressed on this question, the Team is of the opinion that a minimum period of testing for three seasons—or three years, depending on the nature of the crop is necessary. It was recognized that in some cases more testing would be needed especially when the variety was only marginally superior to existing varieties. On the other hand, if the variety was outstanding, period of testing could be cut down. It is, therefore, recommended that the decision as to when the variety should be released should be taken on the merits of each case.

6.31. The testing should be both in research plots and on farmers' fields. The testing on farmers' fields could be organized in the third year simultaneously with the testing in research plots so that the overall testing period may not exceed three seasons or years. In this connection, the Team feels that testing for longer periods would apart from delaying the utilisation of research, also leads to wastage of scientific effort and recommends that there should be no hesitation in deciding to release or discard a variety after three years of testing.

NEED FOR AVOIDING PRE-RELEASE PUBLICITY

6.32. In this connection, it was also brought to the notice of the Team that while many new varieties were advertised in the press and on the air the seeds of these varieties were not available. Demand created for new varieties by such publicity, when sufficient seeds of the variety are not available may lead to exploitation of the situation as has happened in the past with certain varieties. The Team carefully considered different aspects of this situation. The Team is of the opinion that the official release of a variety which means also any publicity relating to the variety should be deferred until reasonable stocks of at least foundation seeds have been built up. Certain steps are, however, necessary to ensure that this does not delay the release of the variety for general cultivation. These steps are :—

(a) Initial multiplication of pure breeder seed

This can proceed hand in hand with the evolution of varieties. This is dealt with in greater detail in Chapter—7.

(b) Pre-release multiplication of foundation seed

The foundation seed agencies should undertake the pre-release multiplication in accordance with a definite plan in co-operation with other research institutes. It should presumably be done simultaneosuly with field testing by extension agencies. It is recognized that the pre-release multiplication of foundation seed carries with it certain risks in that some of the varieties multiplied may not be released, if subsequent testing indicates that these varieties are not really suitable. This, however, should not deter undertaking pre-release multiplication and any organization entrusted with this task will take all these aspects into account in arriving at a proper price structure for foundation seeds of varieties which are ultimately released.

(c) Avoiding Pre-release Publicity

Publicity of all types should be withheld before a variety is released. For this purpose, especially in the All-India Co-ordinated Schemes, all the participating research institutes must agree to a date for release of new varieties and to a plan for increasing breeder and foundation seed. They should scrupulously observe the principle of withholding of publicity till the time when at least sufficient foundation seed is available. On the prescribed date the participating institutes can publish the release of the new variety and its characteristics and inform the general public that foundation seed is being supplied to seed growers and they can expect commercial seed of the variety in the next season. The foundation seed multiplication and the availability of commercial seed should both be on a sufficiently large scale. In order to secure a uniform approach in this matter, a statement of seed multiplication policy should be developed and subscribed to by all the State Governments, agricultural universities, Indian Council of Agricultural Research, foundation seed organizations and agricultural research institutes. Some of the guidelines to be included in the policy statement are—(a) seed producers, distributors and farmers would be informed as early as possible of the value and the adaptation of new varieties, in comparison with varieties already grown, (b) pertinent information as to the basic facts of origin and characteristics and data justifying the multiplication and release of a new variety shall be prepared by the first State or agency releasing the variety and provided to other interested States or agencies, (c) the information used in deciding upon a release of a new variety should be used in presenting the case to seed producers, distributors and farmers, (d) a uniform date for the release of initial publicity should be agreed upon by the interested States. Seed production and demand must be developed together as far as possible. Seed supply and no demand or demand and no seed supply often result in confusion and failure of the variety to make its maximum contribution to agriculture. Thus promotional publicity in advance of the release is not desirable. An educational programme setting forth the superior characteristics, region of adaptation and any special limitations should be co-ordinated with seed supply and (e) some of the questions that need to be resolved and policies that need to be more uniform among the States are—

(i) When prior to release of a new variety should other States and the Central Committee be informed of the impending release ?

(ii) At what time prior to the release should other States be invited to participate in the increase and release ?

(iii) A general agreement concerning the amount of foundation seed that should be available for initial release may be desirable. This would vary from crop to crop.

(iv) A method or formula to be used in dividing breeder or foundation seed among the States that will participate in the initial release to certified seed growers.

(v) With the adoption of the above system it should be possible for scientists and others concerned to exercise restraint in the matter of giving advance and premature publicity to new varieties and in making seeds thereof available to a few farmers, especially in view of the fact that a systematic pre-release multiplication has been recommended.

6.33. To recapitulate in brief the Team recommends that—

(a) no variety should be sold unless it is registered by Central Variety Registration Committee at the national level. The registration will be based on genetic distinctness and uniformity and prior approval of the State or Central Variety Release Committee will not be necessary for sale of varieties so long as they are registered.

(b) varieties taken up in official programmes or given public support should ordinarily be those approved by the Variety Release Committee.

(c) the Departmens of Agriculture in different states as well as the Directorate of Extension at the Central level should continue to test and collect data on field performance of all varieties whether officially released or not and give wide publicity to the data so that farmers may have guidance in making their choice of varieties.

(d) the varieties which are evolved under the co-ordinated schemes and by the Central institutes may be officially released by the Central Variety Release Committee for all the areas of adaptation and these need not be placed before the State Variety Release Committees except for information. The Central Variety Release Committee should be enlarged to provide representation to all the States.

(e) pre-release publicity to new varieties should be withheld and a statement of variety release and seed policy should be drawn up and subscribed to by various agencies concerned.

PRIVATE RESEARCH AND BREEDERS' RIGHTS

6.34. When the Royal Commission on Agricultural Research (1928) recommended a rather limited grant to the establishment of the Indian Council of Agricultural Research, it indicated hopefully its expectation that the grant would be supplemented by private endowments. These expectations have not been fulfilled to the extent hoped for. Industries based on agricultural raw materials have not bestowed enough attention on research in plant breeding and other aspects of crop improvement and development. There is considerable scope and need for investment in crop improvement and development. There is also scope for endowments of a charitable nature in agricultural research.

6.35. From these facts the inference is drawn by some that there is little likelihood of private agricultural research developing in India and the entire question is hypothetical. Some, however, feel that if the Seeds, Act, 1966, is enforced and a quality seed industry develops private research might also develop. One private seed company was of the opinion that crop research was a costly affair and seed companies would not be in a position to take up research at present. A view was expressed by a leading public research institution that there was shortage of good trained scientists even for the various public research activities. They did not see, therefore, much point in encouraging private research at present.

6.36. On the other hand, the majority of the State Government officials as well as others with whom discussions were held were in favour of encouraging private research, though some were not certain about the possibilities in this direction and yet others felt the need for regulating such research.

6.37. The following arguments were advanced in favour of encouraging private research :—

(a) Without a research programme, the seed industry would be reduced to selling agents of products produced by Central or State Government.

(b) Private research agencies could investigate causes of failure of crops and undertake work to remove some faults in local techniques by selection of sub-strains. They will thus help themselves, the farmer and the Government.

(c) There is great scope of increase in the volume as well as diversification of research especially at field or local levels. The major research institutions are likely to increasingly take up more fundamental work and the full exploitation of the available genetic material and scientific knowledge require larger and diversified research effort.

(d) In many crops, research work is yet to be taken up on an adequate scale.

(e) The development of private research would be an additional source of employment and competitional challenge for agricultural scientists.

6.38. The Team has carefully considered the various aspects of developing private research in the present context. It is certainly true that there is ample scope for research work, particularly at field level, for selection of better varieties and strains. A country of the size of India with its variety of macro and micro agro-climatic regions requires a vastly intensified and diversified research. For a long time to come, public research through Government research stations, and agricultural universities will continue to be the dominant source of new varieties and further technological advances. There is, however, need to supplement such research through the efforts of private individuals and organizations.

6·39. To ensure that private research develops on healthy lines and to regulate the supply of breeding materials from public institutions to such private breeders, the Team further recommends that any person or private body desirous of taking up research work in plant breeding should be required to register himself with the I.C.A.R. which should accept the application only after satisfying itself that the individual or the institution concerned has the requisite professional competence and other facilities for undertaking research. The I.C.A.R. may lay down standards for eligibility for such registration. Further, we are recommending separately that any variety claimed to be newly evolved either by public research or by private research should be required to be registered by law before it is sold in the market. Subject to these two restrictions, the private research should be given every possible scope and encouragement to evolve superior varieties. We are of the further opinion that the best results in evolving of better varieties will be obtained by seed companies with their own marketing organisation. In such an event, the assessment of the farmers' requirements as made by the marketing personnel of the seed companies is likely to be reflected in their research programmes and thus lead on to the benefit of farmers. Encouragement of private research is thus linked to encouragement of seed trade and marketing.

6.40. Obviously, a decision to encourage private research implies the availability of genetic material to registered firms or other agencies taking up research work. It has been pointed out that the term breeding material is rather vague and that it includes a wide variety of materials including world collection of genetic stocks, germ plasms as well as lines which are not so raw and have received some attention from plant breeders. The general opinion of almost all the states as well as others was that a liberal policy should be adopted in the supply of breeding material. It is desirable that there should be a free exchange of breeding material amongst various agencies and breeders. Further, when selections in crosses or lines begin, private organizations can be asked to wait till the lines are actually released. When any particular research is in a fairly advanced stage the lines connected therewith should not be supplied to the private agencies. Subject to these limitations, all other basic germ plasm and lines may be made available provided the authority maintaining the lines is satisfied about the genuineness of the party and takes the over-all requirements of the different agencies into account before supplying any particular line. Further, when a private agency evolves a variety or a hybrid making use of a line, supplied to it by a public or other agency the source of the original line and the work done by the original breeder should be clearly and fully acknowledged.

6.41. It has been stated that the very rapid development of high-yielding hybrids in the United States in the public and private sector was due to the free exchange of breeding material. Definite policy guidelines should be developed to meet the following objectives :—

(a) Encourage research by private organization ;

(b) Provide for free exchange and mobilization of genetic material among those interested ;

(c) Apply it equally to all ; and

(d) Follow a consistent policy in responding to the requests.

A suggested policy for making breeding material available is given in Appendix VI.

BREEDERS' RIGHTS

6.42. In almost all the European countries including the U.K. plant breeders are eligible for certain rights similar to patent rights. Once a variety is registered in the name of a breeder he is entitled to receive certain royalties, and he has corresponding responsibility to maintain the breeder stock seeds and arrange for its multiplication and supply. In the U.S.A. the patent laws relating to plants provide for the granting of the patent to any one who has invented or discovered and as equally reproduced any distinct and new variety of plant other than a tuber-propagated plant. Plants which are propagated through seeds are not eligible for patent rights. In India also patent rights do not apply to the new varieties evolved by agricultural research. The justification for the grant of patent rights for agricultural varieties is the same as for patents in the field of scientific and industrial research, namely, that it provides inducement and encouragement for research of commercial value. There were, however, some who felt that the system of breeders' rights was impractical and there would be difficulty in collecting royalties.

6.43. The Team is of the opinion that the system of breeders' rights as a means of encouragement to research by private seed firms can develop only in course of time after private research facilities have been built up. Any scheme that is introduced at present would be applicable to the public agencies only. Even so there is no reason why the work of breeders in public institutions should not be recognised by the grant of rights. It is said that the evolution of a variety in a public research institute is the result of joint endeavour of many scientists and that it would be difficult to ensure that the rights accrue to a particular scientist. But under the breeders' rights scheme, the rights can accrue to an institution and in the case of coordinated scheme the rights can accrue to the Indian Council of Agricultural Research. The Team is aware of the current financial budgeting methods under which all funds received by Government stations are credited to the Consolidated Fund of India or of the State and the funds required for research are voted by Parliament or State Legislature out of the Consolidated Fund. The royalties which accrue thus be utilized directly by the research institutes and so may augment the funds for research. Nevertheless, there is a psychological advantage in the grant of rights and royalties as the institution concerned and its workers would feel honoured by the same. Further, there is no reason why a part of the royalties received by the institution should not be distributed amongst the research workers who participated in a programme on the basis of certain criteria.

6.44. The Team is of the opinion that the breeders' rights system has many advantages. It would certainly result in a certain measure of competition but the fear that it would inhibit exchange of material and foster unhealthy practices might be exaggerated. In the long run, a breeders' rights system would be desirable, particularly as a means of encouraging private research. Immediately, however, it would not be practicable or opportune to introduce the breeders' rights system in the country. Before such a system could be introduced, there should be a well established scheme of registration of varieties on a legal basis. There should also be a certain amount of development of private research. We have elsewhere recommended the development of both private research and the system of registration. When these have developed, the question of breeders' rights system may be considered in due course.

Official Release of Privately Bred-Varieties

6.45. Release of privately-bred varieties by official release committees would be necessary for the varieties to be eligible for certification. The release procedures outlined for publicly bred varieties should also apply to privately-bred varieties. However, the private breeders would themselves have done a number of years of testing before they approach the official release committees. If the official release committees again insist on testing in Government research stations or on farmers' fields for a further period of 2 or 3 years, the release of the varieties would be unduly delayed. It is, therefore, recommended that the official release of privately bred-varieties should be based on testing done by the breeder concerned, and in addition on one year of testing at Government research stations and farmers' fields. If desired, another year of testing may be carried out after the variety is released so that before the seeds are widely available two years' official testing results become available.

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TESTING, MULTIPLICATION AND PUBLICITY FOR NEW VARIETIES IN PRIVATE BREEDING PROGRAMMES

Steps to be taken	First Year	Second Year	Third Year	Fourth Year	Fifth Year	Sixth Year	Seventh Year
Trials ..	Final varietal yield trials by private breeder						
Trials ..			Promising private varieties included in advance trials and results published				
Breeders' Multiplication ..		Seed increase by private breeder					
Registration ..			Apply for Registration*				
Pre-release Multiplication ..			Foundation seed increased on Farms of Private Organisation				
Release ..			Release by Seed Firm**				
Post-Release Multiplication ..				Certified or non-certified seed multiplied by Seed Firm			
Seed to Farmers ..					Certified or non-certified seed to Farmers for Commercial Cropping		
Publicity ..		No publicity		Publicity begins	Publicity intensified by Private Organization		
Extension Education ..				Extension education indicates performance of private var. triasl			

*Anticipated release by Private Breeder—Information submitted to Central Seed Committee for inclusion on National registry based on distinctness.

**Varietal Release Committee determines eligibility to seed certification.

TESTING, MULTIPLICATION AND PUBLICITY FOR NEW VARIETIES IN PUBLIC BREEDING PROGRAMMES

Steps to be taken	First Year	Second Year	Third Year	Fourth Year	Fifth Year	Sixth Year	Seventh Year
Trials ..	Final varietal yield trials on Research Farms after Preliminary Trials indicate superiority						
Trials ..		Trials on Farmers' Fields					
Breeders' Multiplication ..		Breeder Seed on Research Station by Breeder					
Registration ..			Apply for Registration *				
Pre-Release Multiplication ..			Foundation Seed increased on Farms of Foundation Seed Agency				
Release			Release by varietal Release Committee**				
Post-Release Multiplication ..				Certified Seed multiplied by Seed Growers or Seed Firms			
Seed to Farmers ..					Certified Seed to Farmers for Commercial cropping		
Publicity ..	No publicity			Publicity begins	Publicity intensified		
Extension Education ..				Extension begins	Extension Education Intensified		

*Tentative decision to Release—Information submitted to Central Seed Committee for inclusion on National Registry based on distinctness.

**Recommended for release by Breeder or Co-ordinated Programme—Official release by State or Central Variety Release Committee and advance publicity indicating when seed will be available.

CHAPTER—7

ARRANGEMENTS FOR SEED PRODUCTION

7.1. The time taken to produce a new variety is really the sum total of the time taken for the breeding of the variety and the time taken to purify and increase it. Unless proper seed is available (a) without delay ; (b) in pure condition ; and (c) in adequate quantities, there is always likely to be ineffective or delayed utilization of the results of research and the country will not get returns which it can expect from its investment in research. Variety purification and increase has to be a basic part of every research programme.

7.2. Breeder seed forms the basis of all further seed production arrangements. It is the availability of pure breeder seed of a new variety that starts the introduction to the public of the results of research and transmits the increase in agricultural productivity to the economy.

7.3. It is readily and conveniently assumed that the seed which comes from a breeder or a scientist of repute must necessarily be pure and of high quality. This would be so, if adequate facilities were provided and if required attention was paid. A scientist of repute pointed out that, "there were no satisfactory arrangements for the production of breeder seed". The Team strongly recommends that high priority should be given to the provision of facilities in terms of land, equipment, storage, personnel and funds for production and supply of breeder seed. The responsibility of making available required quantities of breeder seed should be fixed on specific institutions.

7.4. The question, whether the breeder seed should be certified, was also raised. The general opinion was that the breeder seed should not undergo the process of certification as it is the responsibility of the breeder himself to ensure the purity of the seed. The Team is, however, of the opinion that the practice followed in Sweden should be adopted to ensure that there are no impurities. This system has been described in detail in Part III—Chapter 15 and constitutes an effective internal check.

7.5. The Team further recommends that the Indian Council of Agricultural Research should standardize the methods of production and maintenance of breeder seed for each crop. They should also ensure the adoption of standard procedures for multiplication of breeder seed in their institutions.

Foundation Seed Production

7.6. Next in importance to the purity of the breeder seed is the purity of the foundation seed and its availability in adequate quantities. The production and distribution of foundation seed are important aspects of any seed programme as they determine the volume of high quality seed that would be available to the farmers.

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7.7. The present arrangements for multiplication of foundation seed in the country fall under three basic patterns :—

(1) In respect of most of the food crops, State Governments have established foundation seed farms in the course of the Five-Year Plans and these foundation seed farms supply foundation seeds of improved varieties. These farms were expected to be of 25 acres each and located in every National Extension Block. In practice, a number of larger sized farms also have been established. In terms of total area, the number of foundation seed farms established by different States is generally considered adequate and in certain States there may be surplus area under foundation seed production.

(2) In respect of hybrids of maize, jowar and bajra, the National Seeds Corporation has been entrusted with the responsibility of production and supply of adequate quantities of foundation seeds. The Corporation has established two foundation seed farms for this purpose and supplements its production by contracting with State Governments, agricultural universities and progressive farmers. In respect of potatoes, breeder seed is supplied by the Central Potato Research Institute. The arrangements for production of adequate quantities of foundation seed are being developed.

(3) In respect of cotton, there is a well-established scheme in different States for the production and supply of foundation seeds. In respect of jute, groundnut and sugarcane, suitable arrangements have yet to be developed fully.

Foundation seeds of improved varieties of foodgrains

7.8. The approach to the production of foundation seeds adopted in the Second Five-Year Plan was that the responsibility for the same rested with the State Governments. Secondly, the concept of self-sufficiency of each Block in the matter of production of foundation seed was introduced. Thirdly, the requirement of foundation seed within a Block was expected to be determined on the basis of plan for coverage of the whole block area with improved seed providing a target date for saturation and replacement of improved seed at regular intervals.

7.9. A Committee set up by the Indian Council of Agricultural Research has recommended that each Development Block should constitute a self-sufficient unit for production and distribution of improved seed and the entire area should be brought under improved seed in a period of five years. The Committee made the following specific recommendations with respect to production of foundation seed on Block Seed Farms :—

(a) The breeder stock seed obtained from the crop botanists should be grown for multiplication on the block farm under the supervision of the Officer Incharge of the farm. In order to maintain the purity of foundation seed produced at the block farm, it was essential that the breeder stock seed was obtained from the crop botanists afresh every year.

(b) Cropping scheme for each block farm should be drawn up in relation to the area under different crops in the block. When more than one variety of a crop has been selected for multiplication, the variety should be grown in isolated plots to eliminate the risk of contamination due to natural crossing and mechanical admixture during harvest. Careful roguing should be carried out to ensure maintenance of the purity of seed.

(c) To avoid all chances of admixture, adequate facilities should be provided in respect of thrashing floor, seed bin, storage space and machinery for thrashing, winnowing and grading and strict supervision exercised at all stages of these operations.

(d) The seed produced on the block farms should be dried to proper moisture content, cleaned, graded, tested for purity and treated against seed-borne diseases before being packed in bags. Samples may be drawn and sent for testing.

7.10. The recommendations of the I.C.A.R. Expert Committee were taken into consideration in formulating a model scheme for multiplication of improved seed in the Second Five-Year Plan. A crucial issue that arose was about the size of the farm in each block. It was recognized that this size would depend on local conditions, but, for the country as a whole, it was estimated that 25 acres would be an average size for saturating, approximately 50,000 acres in 100 villages included in a Block. It would be recognized that these seed farms were meant essentially for foodgrain crops. Although in actual practice some farms were more than 25 acres in extent, still, a larger number were small farms. It is seen that 2,300 farms of varying sizes were set up in all by the end of the Third Plan with about 1 lakh acres as net area available for foundation seed production. It was estimated by the Working Group of the Fourth Five-Year Plan that 32,461 acres would be required for foundation seed production of paddy, wheat, jowar, bajra, ragi, barley, gram and tur and for crops like cotton, jute and groundnut about 3,793 acres would be needed. The Working Group felt that even after allowing for doubling of area to cover risks of low yield by adverse seasons, needs of rotational practices and requirements of minor millets and pulses, the available land on the farms would be more than adequate in some States and there would be no need to set up new foundation seed farms except for crops like sugarcane, potatoes and for areas where there was special need for such facilities. It was, however, felt that there was need to develop and equip the farms properly to improve their efficiency and to take various measures for ensuring the quality of the foundation seed. It may be mentioned in this regard that a number of committees at State as well as Central level have gone into the question of improving the performance of the foundation seed farms both from a financial angle as well as from the quality aspect of seed and a number of improvements have been made in respect of the functioning of these seed farms. Some of the uneconomic farms are being closed down and additional facilities are provided on the remaining.

7.11. It was reported by most State Governments that the performance of foundation seed farms had generally improved since the critical reviews made by Programme Evaluation Organization of the Planning Commission. While this might be so, the reason for establishing a number of small farms to cover every block, for production of foundation seed needs to be examined. Local adaptability of varieties, minimising cost of transport and timely supply of seed have been urged as the main consideration justifying a number of small farms. So far as local adaptability is concerned, the Team is fully aware of differences in micro-climatic regions but is not convinced that there is a need for a foundation seed farm in every block. As regards cost of transport, this should not be a major consideration as assured quality of foundation seed is more important than the cost involved. As regards timely supply, the Team fails to understand why seed grown elsewhere cannot be moved in time. On the other hand, there are positive disadvantages in having small foundation seed farms. The volume of work cannot justify the posting of an experienced and qualified officer and if one were to be posted, would not offer him an adequately challenging task. It is not surprising, therefore, that the Team was informed, that many of the officers incharge of small foundation seed farms would prefer other assignments. Further, the small seed farms were too scattered for systematic and regular inspections by crop botanists or other technical staff at the research institutes supplying the breeder seed. The Team considers that such inspections are absolutely necessary for ensuring quality of foundation seed and breeder seed. Also, the seed yields can be increased and better processing methods adopted on larger farms. With the availability of cosmopolitan varieties in major foodgrains that are adopted to wider ranges of agro-climatic conditions, the question of meeting the local needs by establishing small farms is not of much importance now. Considering all the factors, the Team recommends that in future foundation seed should be produced on adequately large-sized farms in places where required facilities could be provided for the convenience of the staff as well as for the production and processing of quality seed. The existing small farms should also be continued and used for the production of seed of varieties of local importance. The farms which are not located at convenient places and cannot be developed to serve useful purpose even by providing additional facilities and by increasing the size may, however, be closed. The Team recommends that State Governments may arrange for the detailed examination of the working of each of the existing farms and the need, if any, for more farms to meet the requirements of the States. It was reported in some States that the existing farms are being continued on year to year basis and the funds provided are not sufficient. The Team strongly recommends that after detailed examination as suggested above, the farms should be sanctioned on permanent basis and sufficient funds provided.

7.12. The other point which the Team would like to emphasize is the need for advance planning in production of foundation seeds. In such advance planning, there has to be an element of liberal estimating as it would be better to have surplus of foundation seed stocks rather than shortages which would curtail the certified seed programmes and ultimately the entire agricultural production programmes. Based on such estimates, arrangements have first to be made for the production of breeder seed. Unless foundation seed is linked to the supply of breeder seed at least once in three or four years, there will be no generation control and the foundation seed cannot, strictly speaking, be termed as foundation seed. It is recognized that in such advance estimating on a liberal basis, a measure of financial risk is involved. As the varieties may change, the demand may not come up to the expectations and foundation seed stock may have to be written off. But the improvement in the quality of the seed resulting from high-quality foundation seed will lead to greater agricultural production and will compensate for any financial losses that may occur as a result of the above policy. Further, if the planning is carefully done and if sound pricing policies are adopted providing for sufficient reserves, there may not be any overall loss to the exchequer over a period of years. In any case the fear of financial risks should not govern the planning of foundation seed production. The foundation seed agencies must clearly and squarely accept the responsibility for having adequate stocks of foundation seed.

7.13. In this connection, the Team would recommend that a reserve stock of foundation seed should be maintained by the State Governments in respect of all important varieties. These reserve stocks may be kept at convenient centres where good seed storage with control of temperature and humidity should be provided so that the viability of the seed is well-preserved.

Production of Foundation Seed for Hybrids

7.14. The foundation seed production of hybrids of maize, jowar and bajra is quite different from that of foundation seed production in respect of the improved varieties. Hybrids of maize introduced in India are generally double crosses using four lines, though, there are a few three-way crosses using three lines. The foundation seed production in respect of these hybrids requires multiplication and maintenance of three or four inbred lines and one or two single crosses as the case may be for each hybrid. For the hybrids of maize released thus far, 16 inbred lines and 10 single crosses are required to be maintained. The production of these inbred lines and single crosses would normally require two seasons from the date of release of hybrids unless of course pre-release multiplication had been arranged. The National Seeds Corporation was established in 1963 primarily as a sole agency for production and supply of foundation seeds of hybrids of assured quality to farmers. The Corporation also produces foundation seeds of hybrids of jowar and bajra which require the maintenance of two lines for each hybrid. The Corporation has been discharging the above functions since 1963 and currently maintains all the lines for the various hybrids thus for released and makes the foundation seed available to the State Governments as well as to private seed producers. The breeder seed needed for production of foundation seed is obtained by the Corporation from various research institutes in the country. Reserve stocks of foundation seed have necessarily to be carried by agencies responsible for production and supply of foundation seed of hybrids to ensure uninterrupted production of certified seed. The Team was informed that the National Seeds Corporation had a policy of carrying a reserve stock of one year's requirements though this added considerably to the risks and costs. The Team fully endorses this policy and would like to point out that this policy is by no means an unduly liberal one but possibly errs on the conservative side as there might be failures in seed production. However, as a national agency like the National Seeds Corporation can make use of different climatic regions in the country and undertake production of foundation seed at short notice in suitable areas, it should be adequate to carry a year's reserve stock.

7.15. A question has arisen whether there should be (a) a central agency for production and supply of foundation seed or (b) whether different states should have foundation seed production agencies in respect of hybrids (c) or only a few foundation agencies should be developed in the country. A view was expressed that there should be no monopoly in respect of foundation seed production of any kind and competition should be encouraged by establishing a few foundation seed production agencies in different parts of the country. Considering the highly technical requirements of foundation seed production of hybrid crops and financial risks to be borne by a foundation seed organization, a centralized agency at the national level must continue to produce foundation seed of all hybrid crops. The main advantage claimed, viz., that competition amongst foundation seed agencies would result in better quality seed and better service has to be viewed with the fact that the competition might result in over-production in some years, and under-production in some other years. Therefore, when a number of agencies are entrusted with the responsibility of production and distribution and foundation seed, there would be a need for close co-ordination of total production in relation to the total likely demand. The Central Government may set up a Committee to co-ordinate the various foundation seed production organizations in matters regarding the quantities, lines and types of seeds of foundation seed to be produced. With this safeguard and with the increase in the volume of foundation seed required different States and agricultural universities which have requisite facilities, competence and technical know-how should develop efficient foundation seed production agencies. The National Seeds Corporation should continue as a central agency at the national level for the production and distribution of foundation seeds of hybrids and other varieties of all-India importance to meet the needs of those States who have not developed or not in a position to develop, separate foundation seed agencies and producing those seeds which are of inter-State importance. There should normally be not more than one agency in a State for producing foundation seeds of hybrids developed by Government research institutes. The development of various foundation seed agencies in the different States would necessarily take some time and the National Seeds Corporation should, in the Team's opinion, continue to play a major role in the production and distribution of foundation seeds of hybrids for some years to come.

Quality of foundation seed

7.16. To ensure quality of foundation seed it is desirable that all the foundation seeds from which certified seeds are produced should be inspected and certified by the concerned certification agencies that will be established under the Seeds Act. The certification agencies should make arrangements for post-control testing of the foundation seed. Certification of foundation seed should be subject to the condition of satisfactory results from the post-control plots. Besides this, hybrid seed producers who want to have more information on the quality of seed stocks should obtain foundation seed stocks for seed production six weeks in advance of planting and plant in a nursery a minimum of 150 kernels per plot using two replications of each lot of foundation seed stock they have purchased. This shall enable the seed producer to have his own assessment and if a particular lot is weak under field condition, the producer can remedy this by planting a higher rate of seeds. The nursery plots of foundation seed stock should be permitted to grow till harvest. Since they have been planted earlier, the plants will flower and mature earlier than the general seed production fields do so. This enables the seed producer to assess the percentage of shedding in malesterile plots, obvious outcrosses and nicking problems of male and female rows.

Vegetable Seeds

7.17. The present arrangements for the production of foundation seeds of vegetables are unsatisfactory in respect of quantity as well as quality. The Team recommends that the State Governments as well as the National Seeds Corporation should immediately examine the adequacy of production as well as the quality of foundation seed and make requisite arrangements for linking the production of foundation seed with availability of breeder seed. In this connection, it was brought to the notice of the Team that the National Seeds Corporation provides for hot-water treatment of foundation seed before it is multiplied into certified seed in respect of cauliflower. The Team commends such practices as control of diseases is a major aspect of vegetable seed production. The present method of processing and treatment of seeds in respect of vegetables have to be considerably improved and the Team recommends that modern processing and seed treatment methods should be adopted at an early date in respect of foundation seeds supplied for seed production.

Central Reserve Stock for Foundation Seed

7.18. There are a large number of varieties of all-India importance in foodgrains, vegetables as well as in commercial crops. Different States are no doubt responsible for the production and supply of foundation seed in respect of these crops. However, some times demands do arise for these foundation seeds which may not be effectively met within each State. There may be failures in production or there may be under-estimating of likely demand or the demand may be rather sudden. To meet such contingency, it would be in the fitness of things if an all-India organization like the National Seeds Corporation could maintain all-India reserve stock of foundation seeds of important all-India varieties on a limited scale. Also, there are certain seeds for which the production of foundation seeds is highly localised and cannot be taken up in particular States. Also, in the initial stages of release of certain varieties, it may be necessary to produce maximum quantities of seeds by making use of every suitable area and make equitable allocation amongst the different States. The Team recommends that in such cases where the production has to be taken up in some States but the distribution has to be done on an all-India basis, the National Seeds Corporation may take up the production of foundation seeds and make equitable allocations amongst all the States in consultation with the Government of India where the likely demand for foundation seed will be in excess of available supplies.

Foundation Seed Production of Private Varieties

7.19. The Team's recommendations in respect of foundation seed distribution mainly pertain to varieties and hybrids evolved by public research. In respect of foundation seed of varieties evolved by private research, it would be the responsibility of different organizations evolving the varieties to maintain adequate breeder stock seed and it would be the responsibility of agencies undertaking certified seed production to ensure the multiplication of these breeder stocks and maintain adequate quantities of foundation seed.

Production in Government Farms *versus* Production in Private Farms

7.20. A question that often arises is whether foundation seed should be produced on government farms only or whether private farms belonging to progressive farmers should also be utilized for production of foundation seeds. The National Seeds Corporation has been producing foundation seed of hybrids both in the fields of progressive farmers as well as on its own farms, and farms of Central and State Governments and agricultural universities. The State Governments have generally been producing foundation seeds on their own farms. The advantage of production on own farms is that the risk of leakage of foundation seed in an unauthorised manner is very much reduced. Great care and supervision in respect of quality is also possible. On the other hand, private farms have relatively good facilities where personal supervision of a progressive farmer is available, yields can be higher than on Government farms which are usually much larger and on poorer type of land and cannot reach the same level of intensive management. There is, however, no reason why, as a rule, yields on private farms should be higher or quality superior. The Team is of the opinion that foundation seed increase should normally be on farms owned by the Corporation, agricultural universities, State Governments and other public agencies. It is recognised that maximum yields possible should be obtained from breeder stock seed which is multiplied for the purpose of obtaining foundation seed. Hence, only those lands which have high level of fertility and do not have risks associated with climate, pests, diseases, etc., should be chosen for production of foundation seed. The Team further recommends that the selected foundation seed farms should be well developed by provision of land-levelling, irrigation and drainage facilities, processing plants and by appointment of highly-qualified staff for carrying out foundation seed production.

Seed Storage

7.21. Storage of foundation seed is of great importance. We have already referred to the need for providing adequate storage facilities for the foundation seed farms of the State Government. In this section, we confine overselves to the foundation seed storage requirements in respect of parental lines of hybrids, vegetables, grasses, etc. For this purpose, adequate insulation of the storage houses, air-conditioning and dehumidification are very necessary. Further, the seeds should be packed and stored in such a manner that particular lots could be easily identified and the origin of the seed clearly traced. This precaution is necessary, as the basis of quality control in respect of foundation seed is the clear identification of each particular lot. Only where lots are kept in this manner, it would be possible to draw composite samples and test them in the field for genetic characteristics and in the laboratory for their physical purity. The investment on foundation seed storage would necessarily be high, but the investment would be worthwhile and would reduce the write-off rate for all foundation seeds besides ensuring the success of certified seed production.

Allocation policy of breeder and foundation seeds

7.22. Breeder and foundation seeds are very limited in the first one or two years of release of a variety and the demand for such seeds would generally far exceed the available supply. Hence there is need for an equitable allocation of available seeds. Procedures for allocating foundation seed vary from country to country, from crop to crop and from State to State within the country. The objective, however, is to obtain efficient and equitable distribution and a rapid increase of registered and certified seed. In the U.S.A., in many States, there are allocation committees including representatives from experiment station, seed certifying agency and seed trade. If there is adequate supply, it is possible to make a general release, but if supplies are inadequate, pro rata allotments must be made. Growers and seedsmen in some States make an application for foundation seed directly to the foundation seed organization which often requires advance orders and a partial pre-payment. When the deadline for receiving applications is passed and the foundation seed supply is definitely known, the allocation committee meets and considers each request. The applicant often is required to furnish information on the location of the field, provision for isolation, his experience in growing, harvesting and handling registered or certified seed and facilities for cleaning and storing seed. Such a statement may bear the approval of his county agent. The committee gives priority to the most experienced and capable growers in the localities where the crop is of primary importance.

7.23. At present, in India, there are no allocation policies. The result of this situation is that those who are in touch with a particular research institute get hold of some stocks of new varieties and on occasions multiply and distribute the same at exorbitant prices. Taking advantage of such a situation, seeds of many spurious varieties of doubtful quality are also sold to farmers at high prices. This situation can be avoided partly through the measures recommended in Chapter-6 wherein already the need for with-holding pre-release publicity and arranging pre-release multiplication have been stressed. Along with such policies, there should be a clear-cut policy on equitable distribution of breeder and foundation seeds. The Team was impressed with the policies evolved in this regard by various agencies in the United States and feels that we can do no better than to reproduce the policy statement evolved by the Purdue University Agricultural Experiment Station in respect of small grains. This is given in Appendix IV. In essence, the distribution of foundation seed amongst various growers should be made on the basis of past performance in respect of certified seed production though weightage should be given to facilities available with different seed producers, etc. The Team recommends that all Variety Release Committees should adopt similar policies and also communicate such policies to State Governments, universities, seed producers and other users of foundation seed. A different type of allocation system will be needed when an all-India agency produces foundation seed on a national scale for meeting the requirements of different States. In this case, the all-India agency should work out, in consultation with the Central and State Governments, the requirements of each State and make allocations that would be equitable keeping in view the area under a particular crop and the likely demand for the new variety in the various States. Such a policy, however, will not apply where foundation seed is supplied to a particular State purely for multiplication for further increase on the clear understanding that the State concerned will not impose any restriction on the distribution of the multiplied seed to other States. Allocation policies would ordinarily be needed only in the first year of release when foundation seeds would be in short supply.

Certified Seed Production

7.24. The term 'certified seed production' is widely used to denote the production of commercial seed which is sold to the farmer for raising crops. Though technically even breeder seed and foundation seed may be certified, the term 'certified seed' does not refer to these classes of seed. Usually, in crops where the seed multiplication ratio is rather low, there is another class of seed intervening between foundation seed and certified seed, namely, registered seed. In such crops like cotton, groundnut etc., it has been the practice to have one or two stages of registered seed multiplication before taking up the subsequent stage of certified seed multiplication required for the farmers. In this Report, the term 'certified seed' has been used in a very broad sense to cover all stages of multiplication of final seed after the stage of foundation seed. The term 'registered seed' is thus included in certified seed. The object of having more than one certified seed multiplication stage is merely to make up for the low multiplication ratio of certain crops and take some of the pressures of the breeder and foundation seed programmes.

Present Position

7.25. At present, certified seeds of hybrids and varieties are produced by the National Seeds Corporation, agricultural universities, State Governments, private seed companies, private seed producers and co-operative societies. These agencies generally produce seed on their own farms and also on contract with farmers. The general practice is to rely more on contract with farmers than on own production. The quantum of certified seed required is so large that the total requirements of a state cannot be produced on Government farms alone. Further at this stage of production the same technical competence and specialization are not needed as in the case of foundation seed and the risk of leakage of seed in an inequitable manner is much less. Progressive farmers with good facilities and experience can produce high quality certified seed. The Team, therefore, commends the existing practice of multiplying certified seed through farmers.

7.26. The general policy of the Government of India in regard to the production of certified seeds of hybrids as well as varieties is that each State should be self-sufficient in this regard. The State Governments have also the policy of making each block self-sufficient in respect of seeds.

7.27. The argument is also advanced that seed produced in a particular region will be more adaptable for growing in that region and hence the general decentralization of certified seed production is desirable. In the opinion of the Team, however, political or other administrative boundaries should not determine the areas of seed production. The areas of certified seed production should rather be determined by natural advantages, i.e. those areas where good quality seed can be produced without risks of diseases, pests or failures, should be chosen. Quality of seed produced, reliability of seed production, yield per acre, cost of seed production, facilities for seed storage and transport should be the considerations determining the areas of seed production. Reference has already been made as to how in Japan the policy of making each small unit self-sufficient in respect of seed has been given up in favour of production in specialized areas within each prefecture. The question arises, whether, there is any valid reason for adopting the policy of self-sufficiency within each block or district or within each State instead of allowing full play to technical and economic factors.

7.28. It is, undoubtedly, true that there are many varieties which are not widely adaptable and in respect of such varieties there is a certain element of local selection in adapting the variety to particular agro-climatic conditions. In respect of such varieties, there would be an advantage in decentralizing the production as the most appropriate selections would result thereby and the yields of crops would be maximized. There are, however, a number of varieties and hybrids which are widely adaptable and the advantages of local selection may not be so important. In such cases specialization of production in certain suitable areas would be desirable. In other words, whether a variety should be produced in each district or each block or within each State or in the best suited areas in India is essentially a scientific question which must be decided by each producer after ascertaining the scientific opinion on the matter.

Balanced Regional Development

7.29. India is a vast country and every State has within itself large areas with varying climatic and soil conditions. The area under cultivation in each State including area under irrigation and the area required for seed production are compared in Table III. It will be seen that the area required for seed production is only a small part of the area under cultivation. It is, therefore, rather inconceivable that areas which are specially suited to seed production from the point of view of reliability, quality of seed, cost of production, etc., will not be available within the State. If today, some States are more backward in seed production than others, this is not so much due to any natural deficiencies or defects but due to either the availability of better paying crops or due to the mere fact that seed development work is yet to be given impetus by administrations concerned. We consider that it is necessary for the N.S.C. to make an assessment of the potential areas of seed production of the different crops and assist the seed producers and State administrations in developing seed production in these areas with a view to achieving self-sufficiency within each State.

7.30. At the same time, the doctrine of "self-sufficiency in seeds within each State" should not be carried to extreme lengths. The doctrine of self-sufficiency in each State has its limitations. The production of certain seeds may technically be feasible or much cheaper only in certain areas outside the State, e.g. potato, cauliflower and jute seeds. Further, the different seasons and soil conditions in various regions in India should be made full use of to accelerate the seed programme. This is especially important in the multiplication of new varieties where a rapid increase in the initial stock of seed becomes necessary. In such cases, off-season multiplication in suitable areas is very necessary. For example, wheat seed can be produced in summer months in Ootacamund hills in Madras State and in Lahaul and Spiti Valleys in Kashmir, paddy seed can be produced in the summer months economically in the Southern States like Andhra Pradesh. There is no reason why paddy and wheat seeds should not be multiplied in the off-seasons in these areas so that the total availability of seed to the farmers is increased. It would be pertinent to mention that in certain countries special production programmes are arranged even in foreign countries on technical and economic grounds.

7.31. The Team enquired in detail about the difficulties being faced by the seed growers in the production of certified seeds. Thousands of seed growers will be needed throughout the country to produce the required quantity of certified seed and who, as far as possible, should remain with the programme year after year in order that they may gain experience and be able to make their own individual contributions rather than always be dependent upon the seed development staff and the Departments of Agriculture or the technical guidance being provided by the contracting agencies. Before planting, a seed grower should make plans for proper seed processing and for sale and distribution of his seed. The problems of seed marketing are discussed in a separate section, but a reference thereto is made here as we feel that no farmer should take up seed production without first ensuring that he has market for the same. There would be a few farmers with storage facilities, financial resources and enough confidence to undertake the marketing of the seed produced by them. But, by and large, the majority of the farmers would prefer a guarantee purchase at a price fixed in advance. They should enter into contract with the various agencies undertaking seed processing and marketing. The agencies supplying foundation seed to the seed growers should ensure that adequate arrangements have been or can be made in respect of processing, storage, marketing and distribution before supplying the foundation seed for certified seed production.

Selection of Farmers

7.32. In the selection of farmers for seed production, great care has to be exercised by the agency which undertakes seed production. A suggestion was made that the system of tendering should be adopted for selection of farmers. The logic behind the suggestion is that seed production is a profitable operation and an opportunity should be given to all farmers in a block or a district who wish to produce the seed and those farmers should be selected who offer to produce seed at the lowest costs. In the opinion of the Team, this logic is not at all applicable to seed production and would do more harm than good. As pointed out already, seed production is a specialized job and the farmers who take to it must, as far as possible, remain in the programme year after year so that the advantages of specialization should be fully realized. The system of annual tendering will mean frequent change of farmers and the farmers will not make the maximum contribution expected of them. The National Seeds Corporation in the earlier years of its programme had developed the following method for the selection of seed growers. The field staff assessed the facilities available with different farmers and selected those who had adequate facilities and were generally known for their integrity and reputation. Even so in the beginning only a limited acreage was given for seed production to these farmers. If a farmer did a good job of seed production, his acreage was increased. If he did not take adequate interest in seed production, he was dropped from the programme. The following facilities would be required for successful production of certified seed :—

(i) Technical staff.
(ii) Large compact areas under production.
(iii) Isolation availability.
(iv) Irrigation potential.
(v) Assured rainfall region.
(vi) Processing and storage facilities.
(vii) Marketing organization.
(viii) Financial resources.
(ix) Integrity of producer.
(x) Experience of the producer in respect of the particular seed crop.
(xi) Availability of necessary mechanized farm implements.

Not all farmers would possess all the facilities stated above, but the best combination should be selected for seed production.

Seed Village

7.33. In order to ensure that smaller farmers also have an opportunity to take up seed production, the concept of seed village has been developed. Under this concept all the farmers or a majority of farmers, in a particular village contract for seed production and the advantages of compactness of area and large-sized farms are derived thereby. Isolation problems are also solved to some extent in the case of hybrids. The Team recommends that wherever possible seed villages should be encouraged for the production of certified seed. Such seed villages might develop their own marketing outlets or contract with other seed production agencies. There are, however, some practical difficulties like procurement of entire produce and making available grain for consumption etc. in the development of seed villages and seed villages should be developed where conditions are generally favourable to such a programme.

Problems of Seed Production

7.34. Good and well-levelled lands with adequate irrigation and drainage facilities are essential for successful seed production. Many of the farms in India do not fulfil this requirement. There is paucity of land-shaping equipment. Also, in very small farms, land-levelling and land-shaping cannot proceed beyond a certain point without the co-operation of the neighbours. Land-levelling and land-shaping have not developed so far to the extent desired. The National Seeds Corporation imported a certain number of land-levellers and supplied the same to seed producers in the beginning of their operations in 1963. The U. P. Agricultural University had imported its own stock of land-levelling and land-shaping equipment which are being effectively utilized. Many State Governments have also taken up similar operations. There is need for the Government to pay more attention to this problem and to import adequate equipment for land-levelling and land-shaping. Such equipment should be stocked at convenient points and made available to farmers on a custom basis. This is a field in which, in addition to Governmental effort, private effort can also play effective and useful role. It is recommended that seed growers' and farmers' organizations and other institutional agencies be encouraged to offer a complete land-shaping service on a custom basis.

As land-shaping equipment are not manufactured in India, requisite foreign exchange may be made available to such agencies. Commercial banks can play a useful role in providing the necessary finance. The proposed Tarai Seed Development Project contemplates land-shaping services by such agencies.

Isolation

7.35. Next in importance to land-levelling and land-shaping is the problem of isolation in respect of hybrid crops and cross-pollinated varieties and vegetable crops. The problem in respect of cotton in many areas and vegetable seeds in Jammu and Kashmir has been sought to be removed by legislative means. For example, in cotton there is a law which requires only certain varieties to be grown in certain regions primarily for ginning purposes. Other varieties cannot be grown except by avoiding the law. The strict enforcement of this law would certainly lead to varietal purity and upgrading quality of cotton. It will also help in the production of pure seed of the particular variety. There are, however, many problems in the actual enforcement of the legislation, but, by and large, the law seems to be working satisfactorily.

7.36. In respect of vegetable seeds of European type—the cole crops which are highly cross-pollinated—the Jammu & Kashmir Government have enacted a law under which only those varieties permitted by the Director of Agriculture can be grown in specified areas. This is a very essential step as

Isolation Standards

7.40. While on the subject of isolation, it is necessary to point out that the isolation standards prescribed in other countries should not be adopted automatically in our country. The main object of isolation is to prevent contamination by extraneous pollen. On the other hand, prescribing excessive isolation distances will mean adding to the difficulties of seed production. There has not been adequate study in India on isolation requirements. This will, of course, vary from place to place depending on the weather conditions, the force of the wind, the type of crop, etc. The Team recommends that the Indian Council of Agricultural Research should sponsor an All-India Co-ordinated Research Programme in collaboration with the National Seeds Corporation and other seed organizations to determine the isolation requirements appropriate for various crops including vegetable crops of European type in different potential regions in the country.

Problems of Nicking

7.41. It was brought to the notice of the Team that initially hybrid jowar seed production in respect of CSH-1 was considerably limited due to the problem of nicking. The technique of seed production of hybrid jowar involves the use of the male parent (IS-84) and female parent (MSCK-60A) which is a well-known male sterile line. These two lines have different flowering times. The pollen for the female (MSCK-60A) has to be supplied by the male parent (IS-84). Unless they flower at about the same time, the pollen of the male parent is not available and hence there is very poor seed set and on some occasions total failure. The difficulties experienced at the time of seed production were undoubtedly due to the fact that at the time of release of CSH-1, adequate studies had not been made on problems of seed production over a wide area. It is suggested that in future seed production studies should form part of the Co-ordinated Research Schemes and wherever any seed production difficulty is anticipated, study should be started at the various research stations as part of the co-ordinated programme so that when the hybrid is released, the seed production technique is also clearly formulated. Even so, there would be variation in flowering period from place to place and the only solution to this problem is that seed growers should work out the solution in the respective areas and under technical guidance of research workers, the National Seeds Corporation and other agencies. We were informed that the problem in respect of CSH-1 has been, by and large, solved through practical experience in each region and farmers are now able to get very good yields without facing the problem of nicking. However, the nicking problem is not yet fully solved in respect of CSH-2.

Quality of Foundation Seeds

7.42. The seed growers sometimes face serious problems owing to the poor quality of foundation seed supplied to them. When the seed is low in germination or in vigour, the crop and yield are naturally affected, but at least in case of failure in germination it may be possible to replace the same by fresh stocks though in respect of hybrids this causes a problem sometimes in the nicking. But the major difficulty arises where there are genetic impurities in the foundation seed. There has been a general anxiety to hasten the release of hybrids and other outstanding varieties and to adopt them on a large scale in order to increase the overall production. This has led to rather an early release of varieties without adequate purification of the breeder stock seed. Elsewhere, in the section dealing with breeder stock seed production, we have outlined the measures necessary for the production of pure quality breeder stock seed. But sometimes it may become necessary in larger interests to take up seed production programme even with relatively heterogeneous parental seed. When the genetic purity of the breeder seed is not high enough, a decision must be made whether or not to go ahead with increase before re-purification. If it is a variety that is urgently needed and the impurities that exist are not of practical economic importance, there is some justification for increasing foundation seed and supplying the same, stating the impurities that exist. At the same time, a re-purification process should be started. In this manner, a new high-yielding variety may become available three or four years earlier than if one were to wait until a more pure genetic stock was available. If it is decided to take up seed production without waiting for re-purification, the extent and type of impurity should be clearly stated and brought to the notice of all the growers. Every possible step should be taken to prevent any harm resulting from such impurities.

7.43. There is, however, another class of impurity which arises from carelessness or negligence in seed production. This kind of impurity has to be removed by tightening up the arrangements for foundation seed production and processing and the arrangements for quality control in respect of such seeds. This aspect of the problem has been considered in the section on foundation seed and also in the section on quality control.

Availability of Inputs

7.44. There were some complaints on the availability of inputs like fertilizers, insecticides, etc., but, by and large, the situation has considerably improved and seed producers are not finding any difficulty in securing the needed inputs. For hybrid jowar seed production, a systemic insecticide is needed for control of shoot-fly. When this was in short supply, the National Seeds Corporation imported the same and arranged its distribution. The seed production agencies should anticipate the problems of seed production and arrange to import any necessary input that may be in short supply and make them available to the seed producers. In respect of seed production, the Government of India are not likely to refuse the requisite foreign exchange for such imports.

Availability of Water

7.45. Certified seed production should normally be taken up in irrigated areas or assured rainfall areas. Nevertheless, sometimes there were complaints about the failure of seed production due to lack of timely water supply. It was explained that seed production had not been taken up in assured rainfall areas but owing to unusually dry situation which prevailed in 1965-66 when the normal rains did not come and the usual channels of irrigation dried up. It is, however, possible that seed production was taken up in areas without assured water supply. It is hoped that the various seed production agencies would eliminate this kind of hazard in their future seed production programmes.

Technical Guidance

7.46. Seed producers require careful technical guidance as they may not appreciate all the niceties of seed production. This was a major problem faced in the early years of hybrid seed production. However, the problems seem to be solved by the co-operation of progressive farmers and State extension agencies and the work of the National Seeds Corporation in the field. With the increased experience of seed growers and of the various agricultural extension staff of the departments, agricultural universities and the National Seeds Corporation and a better organization of training courses at various levels, the problem of technical know-how in respect of hybrid seed production can be said to have been largely overcome. This, however, is an area in which there is need for continued attention, namely, the efforts to increase yield per acre of seed production and lowering the cost per kg. of seed produced and to upgrade the quality of seed. In this connection, the Team recommends that the National Seeds Corporation and other seed production agencies should make an intensive study of practical problems of seed production in different areas and should suggest measures for resolving the same if necessary by arrangements with research institutes for carrying different studies on such problems.

Difficulties in planting and harvest

7.47. While visiting seed growers the Team observed that even though some attempts have been made to manufacture tractor and bullock-drawn planters these are not suitable for use all over the country. In case of sorghum to avoid shoot-fly, planting is to be done before 15th July in many areas. To see that sorghum is not caught up in the last rains, the planting has to be delayed up to 5th July. That means all plantings of sorghum seed production must be completed within 10 days. In these 10 days also if there is a wet spell, little time is available. This makes it very essential to have precision machinery which can do the work very fast in the limited period available.

7.48. Early harvesting of crops has many advantages. The risk of loss due to bird damage or unexpected adverse weather conditions is minimized. The field becomes free for preparation for subsequent crops. Fodder value of the stover left over is also higher if the crop is harvested early. However, the limitation on early harvest of crops arises from the lack of proper drying facilities. Natural drying is still being preferred in many areas and in some areas where it is not preferred, there is no alternative. It is often contended that in those areas where there are clear long sunny days, there is hardly any need for artificial drying. There is considerable difference of opinion on this question and the Team recognizes that the need for artificial drying in certain seasons with some crops is minimum. For example, artificial drying of wheat seed in the plains is generally unnecessary because of excellent natural conditions. It, however, appears from the purely organizational point of view that drying of many kinds of seeds artificially would be preferable as it would be under better controlled conditions. A separate section deals with recommendations on drying. In areas where hazards of unexpected rainfall, etc. are prevalent, adequate drying facilities should be built up in order to ensure that the seeds are harvested and dried as early as possible.

7.49. In the last two to three years it has been observed that good sorghum and bajra crops which should have yielded very good quality seed have sometimes failed even to qualify for certification due to fungus development, low germination and similar problems when the crop was caught by rains. This probably could have been avoided by using dessicants for quick drying of the crop in the field and by using combine harvestors. The Team, therefore, recommends that :

(a) Specialized planting equipment of those kinds not available in the country be allowed to be imported for seed production ;

(b) dessicants be tested under our conditions and be allowed to be imported. If they prove popular the chemical companies be encouraged to manufacture them locally ; and

(c) combine harvestors be allowed to be imported by seed companies, co-operatives and large farms to assure that the seed harvest can be completed in record time without loss of crop.

Difficulties in procurement

7.50. Sometimes seed growers do not get adequate incentive for the production of high quality seeds. This is, of course, not generally true of hybrid maize, hybrid jowar, hybrid bajra and vegetable seeds where the National Seeds Corporation, the State Governments and seed organizations have been offering fairly attractive procurement prices. In respect of self-pollinated crops, however, the premiums offered generally have not provided adequate incentive for taking special care of the crop for roguing, processing, treating, etc. The Team is of the opinion that any economy in paying of premiums for good seed crop would be self-defeating as it would mean in-attention to the seed crop. The premiums paid for purchase of seeds must be carefully examined so that where they are not sufficiently attractive they may be immediately raised.

7.51. A problem associated with the payment of an attractive price for purchase of seed from seed growers is the leakage in procurement. It is well known that where the purchase prices are not attractive not all the produce of the seed crop reaches the procurement authority. For example, it was reported that jute seed production was often organized by one party but the procurement was effected by certain unscrupulous merchants.

7.52. Partly the problem arises from the fact that the contracting agencies enter into agreement in advance at fixed prices. If at the time of harvest, market prices rise above the contracted prices, farmers are naturally reluctant to hand over the produce at a price lower than the market price. The question of fixing the purchase and sale price of certified seed is described in detail in another chapter.

7.53. Seed production of commercial crops and grasses and fodders would generally be on the same lines as for food crops. However, certain special aspects of seed production relating to some of the commercial crops may be considered as below.

Jute

7.54. A few good strains have been evolved and fairly large areas are already under improved seeds like D. 154, JRC 321, JRC 206, CG, FR-620, etc. Still better strains, viz., JRC 212, JRO 632 and JRO 878 have also been released.

7.55. Breeder stock is produced only in the Jute Agricultural Research Institute. From breeder stock, foundation seeds are multiplied under controlled conditions in the Central Nucleus Jute Seed Multiplication Farm, Budbud, Burdwan, as well as in some State Government farms. They are further multiplied on a fairly larger scale by the State Agricultural Departments in their farms and through registered growers. Those seeds are distributed to the cultivators for fibre production. For some years now, the National Seeds Corporation has also come into field of jute seed multiplication.

7.56. Besides, the growers produce their own seeds on tiny portions of plots which may not have their origin in some improved strains or may be purely local varieties. Seeds that are distributed by the State Agriculture Departments either through their own special staff or through block agencies are of a standard purity. Seeds of fairly good quality are also sold by some reputed dealers, particularly in West Bengal. There are a host of other dealers, fellow growers, etc., in the villages and huts who deal in jute seeds of doubtful quality. But as stated earlier, the main source of supply is the growers' own seeds which for obvious reasons are mostly of local origin.

7.57. The proportion of total requirement of improved seeds produced by the State Governments on their farms and through registered growers as well as by the National Seeds Corporation is rather small.

7.58. Apart from the inadequacy of production, the system of distribution leaves much scope for adulteration, even if the original source of supply is reliable. There is no arrangement for sale of the commodity in closed packets nor is there any system or machinery for certifying the germination percentage and improved character of the seeds. In consequence the growers at times fall victims to unscrupulous deals completed under some fancy names.

7.59. Besides, in spite of the superiority of improved seeds, local non-descript seeds compete with them on the strength of cheapness. For obvious reasons, better strains of seeds have to be priced rather high, but this does not count with the poor growers and make them at least for the time being oblivious of the ultimate gain likely to accrue from the use of quality seeds. It is this price factor as also the shortage of supply that are hampering the spread of improved seeds.

7.60. It is clear that the remedy lies in discouraging the production and use of inferior seeds on the one hand and increasing the multiplication and sowings of improved seeds, on the other. In any programme of improving the present situation the starting point should necessarily be the enactment of the Seeds Act and its enforcement.

7.61. The present Seeds Act, 1966, does not apply to jute seeds and it is recommended that the State Governments should initiate the needed legislation.

7.62. The production plan for improved seeds will have to be formulated on the basis of requirements. The seed producing agencies, however, will be more or less the same as at present, viz., breeder stock to be raised by the J.A.R.I. from which State Governments will produce foundation seeds in the farms earmarked for the purpose. National Seeds Corporation may also raise some quantity of foundation seeds for meeting its own requirements. This will then be further multiplied as certified seeds on a large scale for fibre production. This task may be entrusted to the following agencies—

(i) State Governments in their own farms;
(ii) National Seeds Corporation; and
(iii) Registered growers to be selected by the State Govts.
(iv) Seed companies and co-operatives of repute.

7.63. The price of certified seeds will be higher than that of non-descript seeds. The present unhealthy competition will, however, be stopped after the promulgation and enforcement of the proposed Seeds Act, which will prohibit the import and sale of seeds of sub-standard quality in the notified area. But this will impose a great responsibility on the authorities in the matter of timely supply of adequate quantities of certified seeds to the growers. Any dislocation in the process of distribution will create a chaos and prove detrimental to the interests of the cultivators in particular and jute production, in general.

7.64. For timely supply of improved seeds to the cultivators, it would be advisable to effect distribution through normal trade channel rather than depending wholely on departmental distribution. For this purpose the selling agents have to be made equally enthusiastic about the sale of seeds even in the interior by allowing them such commission as would cover their carrying and handling expenses and would also leave a reasonable margin of profit.

Groundnut :

7.65. Groundnut seed multiplication has generally been unsatisfactory on account of two factors. First is the low multiplication ratio which means that large area has to be devoted for seed production. In order to meet this problem we have already suggested that there should be three stages of multiplication after the foundation seed stage. The large quantities which are required to be handled invariably means large storage space and other expenses.

7.66. Further, the prices of groundnut have tended to fluctuate widely thus resulting in serious risks to any agency which undertakes procurement of seeds at fixed prices or at market prices. The risk is greater when purchase is made on prices fixed much in advance of the selling season.

7.67. In the United States, the Team had discussed this question of fluctuations in prices with certain seed companies. As vigorous forward market operations were available, some of the firms had forward market operation in seeds in corresponding grains in order to cover the risks involved in procurement and sale of seeds. Thus, for instance, when a firm commitment is made at the time of sowing to purchase a certain quantity of seed of a certain crop at a certain price on a future date, on the same day plans are made in the forward market to sell the same quantity at the same price on the specified future date. Any loss or gain in the procurement of the seed owing to fluctuations in price is offset by the gain or loss in fluctuatinons in the forward market. This, of course, is a well known method of hedging against risks, but the difficulty in adopting this system in India would be the lack of a free and vigorous forward in groundnuts and other grains.

7.68. So long as the fluctuations in prices continue, the only method of meeting the same would be to charge a fairly high price to meet the risk; thereby a fund could be built up which can absorb the shocks arising from the fluctuations. Nevertheless, for outstanding varieties, high prices may be acceptable to the farmers and the system of large-scale procurement and distribution of seeds could be justified only in respect of such outstanding varieties. In such cases, a policy of large-scale multiplication and assured procurement can be implemented if a good margin is kept to cover the risks.

7.69. Recently, a Technical Committee was set up to consider the problem of procurement and distribution by the Regional Oilseeds Development Office. The Technical Committee favoured the adoption of a scheme prevalent in Gujarat State with suitable modification. The details of the scheme are given at the end of this chapter. The establishment of seed villages for multiplication purposes was favoured. The Committee felt that rigorous standard should be laid down in regard to quality of seed produced at each stage of production. Mechanical impurities constituted the chief danger. The quick method of categorising the seed into 'A', 'B' and 'C' grades should be evolved for each groundnut variety. The weight of seed content in the bags of standard size should also be standardized since weight of pod is considered an indication of proper maturity and quality. The Committee also recommended that subsidy should be provided in the sale price of groundnut seed to the maximum extent by Rs. 10 per quintal and that a price stabilization fund should be created.

7.70. The Committee was of the opinion that seed procured should not contain more than 8 per cent moisture. It was further felt on the basis of available evidence that there might be a loss of 3-4 per cent in storage due to driage and another loss of 2-3 per cent due to soil particles, etc. in the seed. The Committee, therefore, recommended that the State Government should permit a loss up to 7 per cent. The Team endorses the recommendations made above.

Cotton :

7.71. Quality is all important in cotton. Hence genetic purity of cotton assumes special significance. Under the Cotton Control Acts of Gujarat, Maharashtra and Mysore, growing of varieties other than the specified ones are prohibited in certain areas. There are also controls on the movement of cotton from one area to another. This helps in ensuring the varietal purity of the raw cotton as well as of the seed. Cotton, however, is a partially cross-pollinated crop and quality of seed can be ensured only by efficient certification. There has been a systematic seed multiplication scheme in cotton for a number of years. It was understood that nucleus and foundation seeds are being produced under the direct supervision of cotton experts and the position was generally satisfactory up to this stage. It was, however, mentioned that there is a problem of maintenance of desired purity levels at subsequent multiplications. There is need for an agency to arrange production of cotton seed in compact blocks ensuring adequate technical supervision and certification. Such an agency should be prepared to purchase kapas from growers and provide adequate incentive for the production of the seed crop. It should arrange for the ginning of the cotton taking care to ensure that the cotton seeds are not mixed at any stage. It should further adopt modern processing techniques and packaging and sealing the cotton seed to prevent adulteration.

Potatoes :

7.72. The area under potato is likely to increase to 28 lakh acres from the anticipated area of 18 lakh acres during 1968-69. Out of 28 lakh acres, an area of 10 lakh acres is likely to come under new high-yielding improved varieties of potatoes, which have been released in the recent years from the Central Potato Research Institute and some of them are in the final stages of release and will become available for general cultivation by 1973-74. The total requirement of seed for an area of 28 lakh acres is 20 lakh tons. However, we were informed that it will be possible to take up a planned seed production programme for new high yielding varieties for an area of 10 lakh acres.

7.73. It is estimated that the Central Potato Research Institute will be able to produce 40,000 mds. of basic breeder seed material every year which will be sufficient to cover about 2,000 acres at the foundation seed farms. With the standardization of 'seed plot technique' for the multiplication of seed potatoes in selected areas especially in the northern India plains during winter months, it is possible to have a 10 times rate of multiplication as against 4 to 5 times rate of multiplication in the hill areas which were hitherto considered suitable for maintaining healthy potato seed stocks. The foundation seed will thus be available for 20,000 acres which will produce registered seed for 2 lakh acres. The maintenance of seed stocks will be possible for another year and it is presumed that about 50 per cent of the seed from second stage of multiplication will come to the required standard of health and purity and will be further multiplied as certified seed. Thus, it will be possible to produce certified seed for 10 lakh acres annually. Since the new varieties have a low rate of degeneration seed from traditional source will be covered by seed locally maintained or raised by multiplication of hill seed during spring months.

Vegetables :

7.74. The area under winter and summer vegetables by the end of 1973-74 is proposed to be 32 lakh acres for planned production. The seed requirement for this area with selected vegetable crops which have high nutritive value will be nearly 21,000 tons. All the vegetable seeds can be produced within the country and there will be no need for import of any type of seed. The area requirements for the production of 21,000 tons of seed will be nearly 62,400 acres. Since the quantity of seed required for sowing a unit area in vegetable crops is small except in case of beans and peas, the cost of seed as such is only a small fraction of cost of cultivation. But the quality of seed is of paramount importance for raising the right type of vegetables at the proper time to get the maximum output. The vegetable seed trade is already well organized but there are no checks on production and quality of seed. However, with the Seeds Act coming into force, the quality and purity of seed shall have to be assured by all the seed dealers. As such, it should be aimed to organize the production of vegetable seeds on scientific basis in the more important selected groups of crops. For a production area of 62,400 acres of commercial seed, the area under nucleus seed by one or two stages of multiplication will be only about 100 acres and it should be possible to provide sufficient quantities of nucleus seed by the various research institutes of the Central and the State Governments, the Indian Council of Agricultural Resarch and the agricultural universities.

Soybeans :

7.75. To meet the requirements of anti-biotic factories, high protein food units and animal feed, it is proposed to increase soybean cultivation to produce about 40,000 tons of soybean annually, This will require an area of 80,000 acres to be grown under soybean crop annually. The seed requirement for 80,CCO acres would be 20,000 tons. The National Seeds Corporation, and the U.P. Agricultural University, Pantnagar, have already taken up large scale seed multiplication programmes for soybean and, as such, there will be no difficulty in the availability of soybean seed. Already steps have been taken to import 44 tons of seed of selected varieties from the U.S.A. during 1968-69, and sufficient quantities of seed will thus become available.

Seeds of Forage Crops and Grasses :

7.76. According to the land utilization statistics (63-64), the area under fodder crops in the country is about a million hectares (1963-64) or slightly over 4 per cent of the total cultivated area. The break-up of this area under different fodder crops is not readily available. Some of the important fodder crops, however, are: Jowar, maize, bajra, makchari, berseem, lucerne, guar, cowpeas, pillipesara, methi, oats, peas, carrots, turnips, hybrid napier, guinea grass, sudan grass and para grass.

7.77. Several Groups/Committees which have examined the position regarding the requirements and availability of feeds and fodders for the country's livestock population have come to the conclusion that the present supplies are inadequate and that steps be taken to step up the production of these by increasing the area under fodder crops. A Joint Committee of the Animal Nutrition Committee of I.C.A.R. and the Nutrition Advisory Committee of I.C.M.R. had examined the problem of human nutrition *vis-a-vis* animal nutrition in early fifties and recommended that an area of 63 million acres should be allocated for the production of feeds and fodders. A Committee of the Central Council of Gosamvardhana which examined the problem of cattle feeding in early sixties has recommended that the area under fodder cultivation needed to be increased to about 10 per cent of the cultivated area so as to ensure a reasonable level of nutrition for the country's cattle population.

7.78. The extension of area under fodder crops, it may be stated, is dependent on a number of factors. Some of these are: popularizing of crop rotations with adequate provision of fodder crops, availability of high-yielding, nutritious and quick-growing varieties of fodder crops ; arrangements for supply of quality seeds and planting materials, and highly productive livestock which could provide a reasonable level of return. Adequate production of good quality seeds of fodder crops and arrangements for timely supply of these to cultivators is one of the important items in the programme of popularizing the cultivation of fodder crops. The area under fodder crops is estimated as under :

Year	**Area (thousand hectares)**
1961-62	.. 5,947
1962-63	.. 6,084
1963-64	.. 6,118

For this area, the annual requirements of seeds and planting material of different crops are estimated to be of the order of about 1.50 to 2.0 lakh tonnes ; and this requirement may go up substantially with extension of area under fodder cultivation in the coming years. At present, only limited efforts have been made in this direction.

7.79. In recent years, the evolution of some high-yielding varieties, viz., tetraploid berseem, hybrid napier and giant anjan grass ; adoption of improved cattle breeding and husbandry techniques ; provision of market for milk through dairy development projects ; and extension of irrigation facilities have been leading to gradual extension of fodder crops in intensive cattle development areas, key village blocks and dairy projects. In each of the intensive cattle development blocks it is proposed to have about

20,000 hectares under fodder cultivation and so also in each of the key village blocks it is proposed to have about 800 hectares under fodder cultivation. For these areas alone (for about 10 lakh hectares) the annual requirement of seeds when fully developed, could be around 25,000 to 30,000 tonnes. Some of the important fodder crops, being popularized are : Jowar, maize, berseem, lucerne, cowpeas, pillipesara, oats, hybrid napier, guinea grass, sudan grass, para grass and root crops like carrots and turnips.

Existing arrangements :

7.80. Some quantities of seeds of fodder crops are being supplied by the Indian Agricultural Research Institute, New Delhi, Indian Grassland and Fodder Research Institute, Jhansi, National Dairy Research Institute, Karnal, Central Arid Zone Research Institute, Jodhpur and also by the State agricultural research stations. In addition, the State Animal Husbandry Departments have also taken up production of seeds of selected fodder crops at some of their farms totalling about 80. The area allocated at each of the above farms for seed production varies from about 4 to 8 hectares only. The annual production of seeds at these farms is rather limited and cannot meet the existing demand for the cattle development areas. According to the available information, the State Departments of Animal Husbandry, during 1966-67 supplied about 20,240 quintals of seeds and about 132 lakhs of cuttings of perennial grasses to cultivators under the intensive cattle development and feeds and fodder development schemes. The Departments have largely to depend on local markets for purchase of seeds of fodder crops. It is well known that the seed materials purchased in markets generally could not be relied upon as regards quality.

Requirements for grasslands :

7.81. According to the land utilization statistics, grasslands and permanent pastures and other grazing land constitute about 14.80 million hectares. These areas are reported to have been generally overgrazed resulting in depletion of grass cover. The State Animal Husbandry Departments have taken up improvement of limited grazing areas attached to their livestock farms. The State Forest Departments have, it is understood, initiated grass-improvement work in some of the areas under their control. Under the Soil Conservation Programme, catchment areas of river valley projects are also being rehabilitated with grass cover. Even if a very limited area of grassland is brought under re-seeding programme each year, the requirement of grass seeds would be anywhere between 8,000—10,000 quintals annually. As far as is known, except seed production on a small scale by the Indian Grassland and Fodder Research Institute, Jhansi, Central Arid Zone Research Institute, Jodhpur, some soil conservation centres, some of the State Forest Departments, grass seed production on a sufficiently large scale has not so far been taken up. The varieties of grasses considered suitable for different agroclimatic regions, as recommended by ICAR, are given at the end of this chapter.

Need for proper organizational arrangements :

7.82. It would be seen that the organization for the production of seeds of fodder crops and grasses needs to be strengthened at all levels. In this regard, the Indian Grassland and Fodder Research Institute and the Indian Agricultural Research Institute, should organize co-ordinated research on different fodder crops and grassland development in collaboration with the State agricultural research stations, agricultural universities and State Forest and Animal Husbandry Departments, as the case may be. The nucleus seed material may, thereafter be multiplied at the N.S.C. seed farms, State Seed Farms, State Livestock Farms and Regional Forage Demonstration Stations. The seed material could then be further multiplied through registered seed growers. The procedure for seed certification and agency for distribution in the States should, as far as possible, be the same as for the seeds of other main crops.

ANNEXURE TO CHAPTER 7

SYSTEM OF SEED MULTIPLICATION AND DISTRIBUTION IN GUJARAT STATE

Stage-wise Multiplication :

The efforts to introduce and saturate the entire area under the crop while assuring the maintenance of minimum of 88 per cent genetic purity, need invariably be associated with a systematic and scientific approach to the multiplication programme commensurate with the hugeness of the problem. Following stages with relevant genetic purity have been proposed for operation for groundnut seed multiplication programme taking into consideration the seed-rate, seed-multiplication ratio, yield averages, etc. The area against each stage is proposed for a Unit area of one lakh acres :—

Serial No.	Name of Stage	Genetic purity percentage	Area required under the stage to ultimately cover one lakh acres	Stage seed growing	*Scheme personnel concerned*	
					Directly responsible	Helpingly associated
1	2	3	4	5	6	7
1	Breeder Stock	Each Plant absolutely true to type	0-05	Breeder's plot at Central Oilseeds Research Station, Junagadh	Oilseeds Specialist, Gujarat State, Junagadh	Oilseeds Extension Officer, Gujarat, State, Junagadh
2	Nucleus . .	100	2-00	Research Stations TCD and Agricultural College, Farm	Head of the Research Station of College Farm	Assistant Oilseed Extension Officers in their Divisions
3	Foundation	98 and above up to less than 100	20-00	Taluka Seed Farm and GTC and Agricultural School Farms	District Agriculture Officer for TCF, Principals of GTO and Superintendent of Agricultural Schools	Agricultural Supervisors of the scheme
4	A. Stage	96 and above up to less than 98	160-00	A-Stage Regd. seed growers in Seed Villages	Agricultural Asstt. of the Scheme	Extension Officer (Agri.) of Taluka Panchayat
5	B. Stage	94 and above up to less than 96	800-00	B-Stage Regd. Seed growers in Seed Villages	Agrl. Asstt. of the Scheme	Extension Officer (Agri.) of Taluka Panchayat
6	C-Stage	92 and above up to less than 94	4,000-00	C-Stage Regd. Seed growers in Seed Villages	Agrl. Asstt. of the Scheme	Extension Officer (Agri.) of Taluka Panchayat
7	General Stage	90 and above up to less than 92	20,000·00	Selected growers in VLW Groups Villages	Gram Sevak	Agricultural Asstt. of the Scheme
8	Non-Stage or Natural spread	88 and above up to less than 90	80,000.00	All the groundnut growers except those in any of the A.B.C. and general stage cropping	Do	Do

The stage of the seed in its various stages of multiplication will be stayed after the seed meant to grow the stage, for example, the product of foundation seed crop will be 'A' stage seed stored at the Taluka Seed Farm but meant for growing 'A' stage crop with the 'A' stage registered seed growers in seed villages. There will thus be the stage of the crop changed with the production of the seed later up to its next production.

Those mentioned as 'directly responsible' under item 6 above will be guiding and attending directly the growing of the crop by intensive methods, roguing as and when necessary, production of seed, grading, labelling and sealing, storing and distribution to next stage. Those mentioned as 'helpingly associated will help the farmer in the execution of the above.

Stage-Seed Village and Registered Seed Growers :

Selection of a stage-seed village from among the villages of the gramsevak or jointly of the groups of villages of gram-sevak in case the individual group has a total of less than 3,000 acres under groundnut in Rajkot Division and 3,000 acres in Baroda Division, may be made on the consideration of the following five points :—

(1) The village may, as far as possible, be in or near the central position of the group.

(2) The village may have fairly good protective irrigation facilities.

(3) The village may have a good co-operative society duly interested in seed transactions.

(4) The village may have suitable strength of progressive groundnut growers duly qualified and interested in being registered seed growers.

(5) The village may have total acreage under the groundnut crop which may not be less than total acreage required for A, B and C stages for the group acreage under the crop.

The selection of the stage-seed village is done in consultation with the extension staff of the Taluka Panchayat.

Selection of registered seed growers is done in the stage-seed village on the following items under agreement from them : —

The registered seed grower should agree to :—

(1) Grow the stage-seed under intensive methods of cultivation.

(2) Grow the stage-seed in the land possible to be protectively irrigated or grow the stage-seed in the land best suited for the crop in the tract devoid of irrigation possibilities.

(3) Maintain absolute purity in the standing crop as also in harvesting, threshing and storing.

(4) Grade and sell the produce to the next stage registered growers or to licensed holder at the then prevailing and mutually agreed rates or exchanges.

The programme of fixing almost permanently the stage-seed villages and registered seed growers will make the seed multiplication programme self-sufficient at the lowest level. Such arrangements not only bring in necessary specialization of seed production programme but also help scheme staff in having definite village to deal with almost permanently.

VARIETIES OF GRASSES

I. Northern West Region :

1. Sewan (Lasimas sindicus).
2. Anjan (Cenchrus ciliaris).
3. Dhanan (Cenchrus setigerus).
4. Panicum turgidum.
5. Urochloa mosembecansis.
6. Cenchrus glaucus.

Gujarat Region :

1. Dicanthium annulatum.
2. Dicanthium caricosum/nodosum.
3. Ischeamum rugosum.
4. Cenchrus ciliaris.
5. Green Panic.
6. Blue Panic.
7. Chloris gayana.
8. Para Grass.

II. Central (Bundelkhand) :

1. Dicanthium annulatum.
2. Iselima laxum.
3. Chrysopogon montanus.
4. Green panic (semi-irrigated).
5. Chloris gayana.
6. Napier (irrigated).
7. Para grass (irrigated).

III. Deccan (Peninsular India) :

1. Dicanthium caricosum.
2. Sehima nervosum.
3. Chrysopogon montanus.
4. Iselima laxum.
5. Napier (irrigated).
6. Para grass (irrigated).

7. Chloris gayana (Semi-irrigated).
8. Guinea grass.

IV. Southern States :

1. Isilema laxum.
2. Dicanthium annulatum.
3. Cenchrus ciliaris.
4. Cenchrus glaucus.
5. Pennisetum pedicellatum.
6. Guinea grass.
7. Para grass.
8. Napier grass.
9. Setaria sphacelata.

V. North-East :

1. Pennisetum pedicellatum.
2. Chrysopogon montanus.
3. Dicanthium caricosum.
4. D. annulatum.
5. Brachiaria brizantha (in West Areas).
6. Napier (irrigated).

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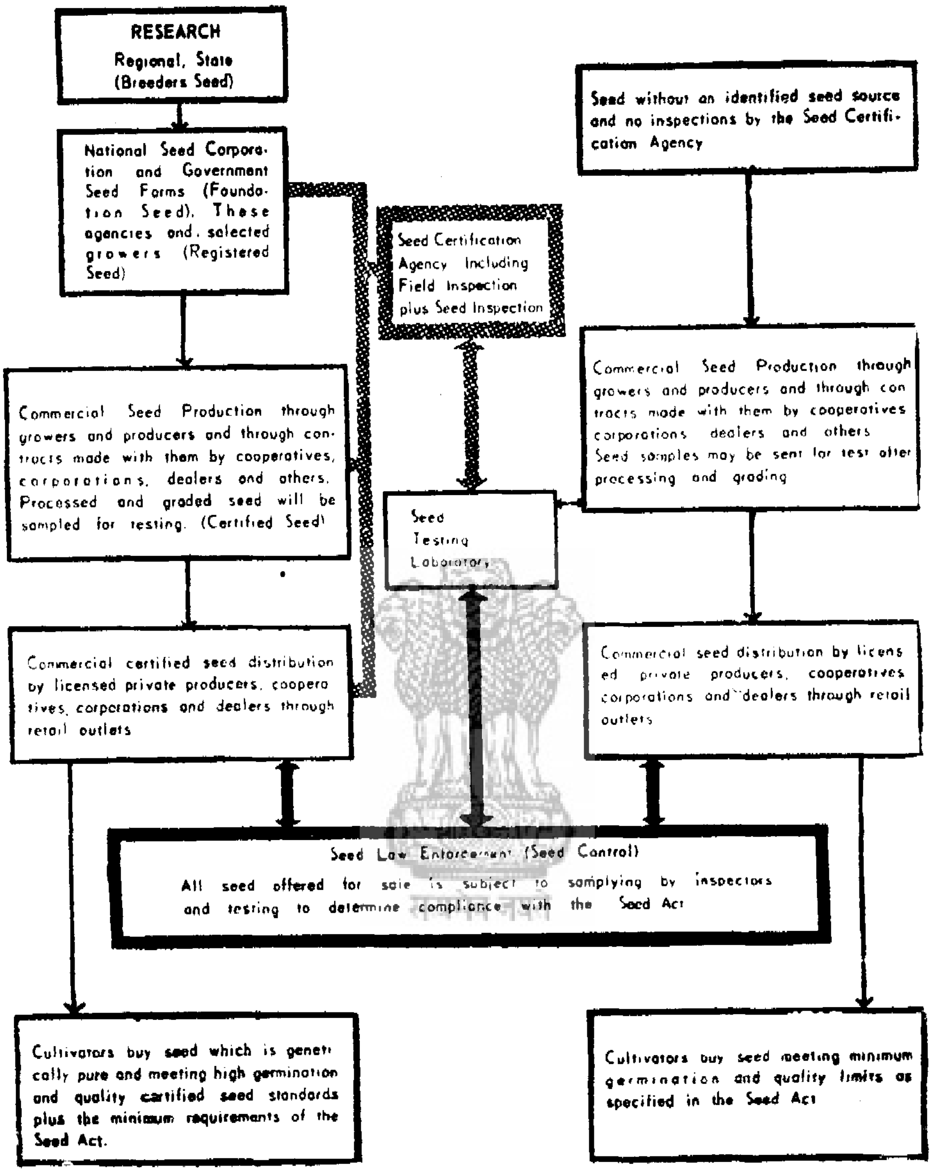
CERTIFIED SEED PRODUCTION

SEED PRODUCTION UNDER ONLY THE SEED CONTROL PROGRAM



RESEARCH
Regional, State
(Breeders Seed)

National Seed Corporation and Government Seed Farms (Foundation Seed). These agencies and selected growers (Registered Seed)

Seed Certification Agency Including Field Inspection plus Seed Inspection

Commercial Seed Production through growers and producers and through contracts made with them by cooperatives, corporations, dealers and others. Processed and graded seed will be sampled for testing. (Certified Seed)

Seed Testing Laboratory

Commercial certified seed distribution by licensed private producers, cooperatives, corporations and dealers through retail outlets

Seed without an identified seed source and no inspections by the Seed Certification Agency

Commercial Seed Production through growers and producers and through contracts made with them by cooperatives corporations dealers and others Seed samples may be sent for test after processing and grading

Commercial seed distribution by licensed private producers, cooperatives corporations and dealers through retail outlets

Seed Law Enforcement (Seed Control)
All seed offered for sale is subject to samplying by inspectors and testing to determine compliance with the Seed Act

Cultivators buy seed which is genetically pure and meeting high germination and quality certified seed standards plus the minimum requirements of the Seed Act.

Cultivators buy seed meeting minimum germination and quality limits as specified in the Seed Act

CHAPTER—8

SEED PROCESSING

Importance of Processing

8.1. New and improved crop varieties become an important agricultural input only when seeds of such varieties are made available to farmers in a viable condition, varietally pure and free from contaminants such as inert materials, weed seeds and immature seeds. Seed processing is an integral part of the technology involved in transforming the genetic research of the plant breeder and geneticist into improved seed. In its broadest sense, seed processing encompasses all the steps involved in the preparation of harvested seed for marketing, handling, threshing or extracting, shelling, pre-conditioning, drying, cleaning, size grading, upgrading, treating and packaging.

8.2. Traditionally farmers have been aware of the need for dry, clean and good quality seeds. Progressive farmers have always taken special care in the harvesting, preparation and storage of selected grain intended for sowing. However, the methods adopted had their limitations, as they were not based on standardized techniques resulting from scientific research and could not ensure uniform reliability. Nor were the methods adequate for handling large quantities of seeds. In the case of certain crops only and in certain areas, the traditional methods were not adequate to cope with the problem of ensuring germination and ensuring freedom from contaminants. Hence, as seed trade developed and the need for ensuring supply of reliable quality seeds was recognized, scientific and mechanical methods of processing were increasingly adopted.

8.3. The aims of processing are primarily—

(a) to thresh or shell or extract the seeds without mechanical injury ;

(b) to reduce the moisture quickly to desired levels and thus increase the longevity of the seeds ;

(c) to remove contaminants and upgrade physical purity of the seeds ;

(d) to treat the seeds with fungicides and insecticides to protect seeds against fungi and insects ; and

(e) to make the seeds in a lot more uniform thus improving plantability and also appearance of seeds, which in turn increases their acceptability by the farmers.

8.4. The seed processor plays an important role in the preparation of the seeds for marketing. Regardless of its inherent capacity to yield, the quality of the final seed is directly related to the efficiency of the processes adopted to achieve the aims listed above. This efficiency depends to a large extent on the types of processing and handling equipment used, the skill in operating them and the knowledge of seed characteristics and their relation to the methods of processing. It is inconceivable that quality seeds of improved varieties and hybrids could be made available to the farmers in quantities without a high degree of mechanization of the many steps involved in the processing and preparation of seed. Seed processing, therefore, involves move mechanical skills and engineering principles than is commonly recognized.

8.5. In developed countries, a variety of equipment are used for processing seeds. They range from simple winnowing trays to complex and sophisticated equipment, such as the electronic sorters. The choice of the machines and their sequence depend on the quality and kind of seed to be processed, the nature and types of contaminants, the quantity of each such contaminant in the raw seeds and the quality standards that must be met. The seed processor must, therefore, be as familiar with seed characteristics, market requirements, seed certification standards and seed laws, as he is with the seed processing equipment. For some kinds of seeds, a simple processing line consisting of one machine coupled with handling and bagging equipment is adequate. In the case of other kinds of seeds, complex processing lines consisting of several machines arranged in sequence and matched for capacity, a number of holding bins and different types of elevators and conveyors are required for complete processing. Flexibility is also necessary so that the line can be tailored and organized to handle each kind and each lot within a kind in the most efficient manner. Considerable attention and thought is necessary in the arrangement and layout of the equipment bins and conveyors within the seed plant. Seed processing involves a high degree of operational skill and expertise that can only be attained through experience and constant study.

8.6. The modern seed processor must choose that combination and sequence of machines, which will ensure—

(a) *High Quality*.—i.e., absence of mechanical injury, desired moisture level, good viability, physical purity, etc. ;

(b) *Minimum seed loss.*—In every processing operation some good seeds are removed along with contaminants, but this loss must be kept to the minimum ;

(c) *Efficiency.*—The highest capacity consistent with achievement of desired quality standards ;

(d) *Minimum labour requirement.*—Labour is a direct operating cost and needs to be kept to the minimum to improve profitability.

8.7. Seed processing operations consist of several definite steps that follow in a specific sequence. The first step is receiving the seeds which arrive at the processing plant in bulk or in bags and storing in bulk for later processing or directly feeding into the processing line for cleaning. The second step is threshing, shelling or extracting the seeds and conditioning and pre-cleaning them for removal of appendages and large pieces of trash. The third step is drying to the correct moisture level. The fourth step is actual cleaning and/or upgrading which is the basic cleaning process. Some seed lots may come from the field with few contaminating seeds and may require cleaning only on the air screen machine. Sometimes, however, it may be necessary to use one or more special types of machines to remove specific contaminants. Also, often associated with cleaning is the sizing of seeds to improve uniformity, appearance and plantability. The fifth step is treating with fungicide and/or insecticides. The final step is the weighment and bagging of seeds.

Seed Processing Technology in Advanced Countries

8.8. Seed processing has made repid strides in the developed countries, like Sweden, the Netherlands the U.K. and the U.S.A. which the Team had the opportunity to visit.

Shelling, Threshing and Extraction

8.9. In the advanced countries, mechanical methods of harvesting are widely adopted. As distinct from grain-harvesting, harvesting and subsequent operations on shelling, threshing or extraction of seeds require great care to avoid any possible mechanical damage to seeds. The Team was impressed with the mechanized methods of extraction of vegetable seeds in large volumes.

Pre-cleaning and conditioning equipment

8.10. *Scalpers.*—Scalping or rough cleaning is regarded as a basic operation, as seeds harvested with combines are often heavily contaminated with foreign material, such as sticks, leaves, trash stems, and weed seeds. These need to be removed before seed can be safely stored, efficiently dried or effectively cleaned. By removing most of the trash or green material, seedsmen encounter fewer handling problems, reduce drying costs and save on storage space. Scalper is the first piece of equipment used when seed comes in from the field to rough-clean all seed lots that are to be dried or stored prior to being finally cleaned. Scalping increases the capacity of the air-screen cleaners by minimizing feed hopper stoppages and enables more accurate and sensitive machine adjustments. Many different sizes and types of scalpers ranging from high capacity receiving scalpers to small reel scalpers fitted as standard equipment on other machines are used. When a scalper is used, capacity should not be sacrificed in favour of more thorough cleaning, since final cleaning will be made on the air screen cleaner or other types of machines.

8.11. *Debearders.*—For efficient and effective seed cleaning, the seed must be completely threshed and as 'free flowing' as possible. Generally, these requisites are not always met because of inefficiency in threshing and harvesting equipment and/or peculiarities in the morphology of the seed heads or units. Seeds of some forage grasses and small grains have awns, beards or glumes that are not completely removed during threshing. These cause the seeds to cling together and prevent effective size separations. Removal of these appendages helps more efficient cleaning and accurate planting. In certain other cases, harvested seed contains unthreshed pods, seed heads or clusters of seeds that are much larger than the completely threshed seeds. These cluster heads or pods must be completely broken up before the seed is cleaned, to minimize 'good seed' losses. Seedsmen in advanced countries use a machine called a 'debearder' to eliminate many of the difficulties described above and to prepare the seed better for the various cleaning operations. Basically, this machine completes threshing of unthreshed or partially threshed seed and removes appendages or hulls that interfere with the flow of the seed and prevent effective sizing separations.

8.12. *Huller-Scarifier.*—Some seeds require hulling, while others need scarifying. Some seeds principally legumes and grasses, require hulling prior to cleaning and scarification after cleaning. The terms 'hulling' and 'scarifying' refer to two different processes. In hulling only the hull or husk surrounding the seed is removed while the seed itself remains unscathed. This is generally done to improve the efficiency and effectiveness of subsequent cleaning operations. In scarification, the seed coat itself is scratched or ruptured to facilitate absorption of water and hasten germination. In other words, hulling and scarifying hasten germination by removal of growth inhibiting parts or by increasing the permeability of water or oxygen.

DRYING

8.13. *Drying.*—The time honoured method of drying grain or seed under the sun is no more adopted in the developed countries who have taken to mechanical drying which have the following advantages :—

(a) Whether it is a grain crop or seed crop, with mechanical driers the grower can afford to harvest the crop earlier than usual, i.e., immediately on maturity without waiting for on-plant drying.

(b) Growers can plan the use of man-power and programme for the second crop accurately. The uncertainties that result from depending on field drying are eliminated. Mechanical drying, therefore, helps in the more efficient use of land and man-power.

(c) Earlier harvesting considerably minimizes shattering losses in the field as also losses due to various pests, birds and other animals and due to diseases.

(d) Most important of all, good and uniform drying facility helps production of good quality seeds. Such facilities permit drying to safe and uniform moisture levels, using precisely controlled drying temperatures that help maintain a high germination percentage.

8.14. Wet seed undergoes both chemical and physical changes and is preferentially attacked by insects. Mold is another important danger to wet seed. The object of mechanical drying is to reduce the moisture content to safe storage limits as quickly as possible. The drying time is related to (a) temperature of grain and (b) moisture content. The fundamental question that a Seed Technologist has to face is how quickly to dry the seeds to ensure proper keeping qualities. The optimum conditions have to be studied and the driers will have to be suitably designed. The design for the driers not only depend upon these optimum conditions but on various other factors, such as the characteristics of the crop, temperature and humidity. In other words, the design of the units must take into account these technological and engineering aspects.

8.15. Different types of dryers are used depending upon the various factors enumerated above and the crops. The basic types are as under :—

(a) Batch dryers generally used for maize—

In this, heated air is blown through a series of drying bins in which maize cobs are stored.

(b) Flow Bed Type Dryer—

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In this type of dryer, the seed to be dried flows steadily on a horizontal bed. The heated air is blown through the seeds from below. This is mainly used for wheat and other grains.

(c) Tower Type Dryer—

In this system, the seed is moved through a tray of heated air. The seed may be moved more than once, if necessary.

(d) Bag Dryer—

Forage and vegetable seeds in bags can be dried by the flow of heated air through the bags.

(e) Vegetable Seed Dryer (Rotating Drums)—

The heated air is passed through perforated rotating drums in which seeds are placed. The drums rotate very slowly giving a gradual drying effect on the seeds with continuous movement of seeds.

(f) Tray Dryers—

Vegetable seeds in trays are put inside chambers through which heated air is driven.

Oil fired engines which are driven by appropriate fans are generally used for heating up the air. Automatic controls are required for drying and in fact can be considered to be the most important aspect as excessive heat can spoil the germination. Inadequate heat may also prolong the drying period and result in mould development and other deleterious effects.

Basic Seed Cleaning and Upgrading Equipment

8.16. *Air-screen Machine.*—The air-screen machine is the basic cleaner in most seed processing plants. Almost all seed must be cleaned by an air-screen cleaner before specific separations can be attempted. Many seed lots can completely be cleaned by this machine. There are many styles and types of air-screen machines. Machine size varies from small, two-screen farm models to large industrial cleaners with 7 or 8 screens, three or four air separations and capacities up to 3 tons of seeds per hour. Small two-screen models are used on farms, in breeder and foundation seed programme and by experimental stations for processing small quantities of seeds. Three and four-screen machines fit into various size operations and are selected for precision as well as greater capacities. The 5 to 8 screen machines are used primarily for processing grain, where high capacities are essential. In selecting the size and type of air screen cleaner for a particular operation several factors must be considered, such as power requirements, amount and kind of seed to be processed and ease of cleaning the equipment.

8.17. For effective separation, cleaning or processing, the components of the lot or mixture must differ in some physical characteristic. In most machines separations are made on the basis of differences in only one physical characteristic. The air-screen machine, however, effects separations on the basis of differences in size and weight of seeds. Size and weight being the most common difference among seeds and between good seed and undesirable material, separations based on size and weight basically cover a very wide field and hence air-screen machines are very largely used in basic cleaning operations.

8.18. The air-screen machine uses three cleaning elements—*Aspiration*, in which light material is removed from the seed mass, *scalping*, in which good seeds are dropped through screen openings but larger material is carried over the screen to a separate spout, and *grading*, in which good seeds ride over screen openings while smaller particles drop through.. The air-screen machine uses a series of perforated sheet metal or woven wire screen to separate seeds of different sizes. One or more air blast separations remove light material. In a typical air-screen machine, the seed mixture drops through an air blast onto several screens, and then through a second or even a third air blast where remaining light material is removed.

8.19.* The first screen has perforations large enough to allow the crop seeds to drop through. Larger undesirable material does not drop through the openings, but rides over the screen and drops out through a separate discharge spout. The crop seeds then fall onto a second screen which has openings smaller in size than the crop seeds. As the seeds pass over this screen, all seeds, seed pieces, or inert-material, smaller than the good crop seeds, drop through the screen openings into a discharging spout. Good seeds ride over this screen, and may pass onto additional screens for finer and closer size separations, or be moved to other machines, or bagged.

8.20. Two types of screen sizings are made : (1) *Scalping*, in which good seeds drop through the screen openings while larger material is carried over the screen into a separate spout, and (2) *Grading*, in which the particular grade seeds ride over the screen while smaller particles drop through the screen openings. A series of scalping and grading operations remove all materials larger or smaller than the crop seeds. The paramount feature of the air-screen machine is the wide range of available screens—over 200 different sizes and shapes of perforations. Seed processors must know the characteristics of crop seeds and material to be removed, how to operate the machine, and have available all scalping and grading screens needed to remove undesirable material from the crop.

8.21. *Dimensional sizing equipment.*—Several seed separations are made by width or thickness sizing. Width or thickness separations are made by turning the seed on edge or standing it on one end to present its width or thickness dimension to perforations of specific size. If the seed is less than the selected width or thickness it will drop through the perforation ; if it is greater than the selected width or thickness it willnot go through and will be discharged into a different spout.

8.22. *Width and thickness separators.*—These are commonly referred to as "graders" or "sizers" in the seed trade. Although substantially accurate, these terms are, nevertheless, misleading, for they foster the concept that these machines have a very limited application. Width and thickness separators are more widely used in the seed industry than generally realized. They are as effective in removing contaminating weed seeds and other crop seeds, as they are in size-grading of maize or groundnut. Width and thickness separators are capable of an extremely sensitive, or precise separation of particles according to their width or thickness dimensions. The separation is similar to, but generally more accurate than, the separation performed on the screens in a conventional air-screen machine. All these separators employ gravity, centrifugal force, product pressure or a combination of these forces to make width and thickness separations on screens. Seeds are sized for width by using round-holed screen openings and for thickness by using slotted screen openings. All large maize seed processors use width and thickness separators to size grade corn for precision planting

8.23. *Disc and Cylinder Separators.*—These are specifically designed to effect separations of particles differing in length. These are the only machines used in the seed trade to separate seed on a pure length difference basis. Both these types of machines effect separations by lifting the short particles out of a mixture containing both long and short particles. They are most effective when the undersized or short particles are relatively uniformly dimensioned. For most effective and efficient use these machines are to be used only after the air-screen cleaner. Length separators are largely used in the cleaning of small grain, grasses and legumes to make separations of weed and other crop seeds that cannot be separated by any other method.

8.24. *Spiral Separators.*—These are designed to effect separations based on the shape of seeds. Separations made by the air-screen machine are often related to differences in shape, especially when triangular-holed screens are used. Spiral separators are essentially designed to separate round from flattened seeds based on differences in roundness or their ability to roll.

8.25. *Gravity Separators.*—Many seeds differ in weight, specific gravity or relative density. Weight or specific gravity is the effective separation principle in the air blast separations in air screen machines. However, undesirable seeds and contaminants are often so similar to the good seeds in size, shape and seed coat characteristics that efficient separations cannot be effected by air screen or dimensional sizing machines. These undesirable materials, however, may differ from the good seeds in unit weight or specific gravity. For example, insect damaged seeds often retain the same dimensions as undamaged seeds, but are much lighter because of interior destruction of seeds by the insects. Deteriorated or rotten seeds are usually similar in size to good seeds, but have a lower specific gravity and consequently are much lighter. Seed coats, hulls or other coverings develop normally and in terms of shape and size, empty, blind or sterile seeds look like good seeds, but they are always much lighter, than fertile seeds. Machines like the gravity separators, the stoner, the aspirator and pneumatic separator are all designed to make specific separations by differences in weight or specific gravity of seeds.

8.26. *Dodder Mill and Magnetic Separators.*—Relative roughness or smoothness of the seed coat—surface texture—is a common difference between seeds. Seeds also differ in their affinity for liquids or the rate at which their surface will absorb liquids. The roll or dodder mill, the draper belt, the magnetic separator, the buck-horn machine and vibrator separator all effect separations of seeds differing in surface texture of affinity for liquids.

8.27. *Electronic colour sorters.*—Many seeds differ in colour or reflectivity. Colour separations are used more and more in processing, particularly with the larger crop seeds. Electronic colour sorters make colour separations. These machines present each seed to an electronic sensing device which compares the seed with an electronic pattern or a given colour background. If the seed's colour, hue or reflectivity is acceptable, it is allowed to continue to a discharge spout. Seeds not in the acceptable range of colour, hue or reflectivity are divided and separated from the main stream by compressed air or other devices.

8.28. *Electro-static separators.*—Seeds also differ in their ability to hold or conduct an electrical charge. Although many conditions affect a seed's electrical properties, consistent differences in such properties can be used to make some difficult separations. The machine which separates seed on the basis of electrical properties is called an electrostatic separator. A typical electrostatic separator consists essentially of a conveyor belt which carries a single layer of seed beneath an electrode.

8.29. *Seed Treating Equipment.*—The application of seed treatment materials is a very specialized operation and is usually the last step in the processing of seed. Seed treatment materials are applied as dusts, slurries (a mixture of wettable powder and water) or liquids. The equipment used to apply chemicals, in any form, to seed are classed as seed treaters. There are many types of treaters available, varying in size and capacity. Slurry treaters work on the principle of suspension of wettable powder treatment material in water. The treatment material in the form of a slurry is accurately metered through a simple mechanism composed of a slurry cup and seed dump pan. The cup introduces a given amount of slurry with each dump of seed into a mixing chamber where they are blended. Slurry treaters are adaptable to all types of seeds. The small amount of moisture added to the seed, 1/2 to 1 per cent of the weight of the seed, does not affect seed in storage, since the moisture is added to the seed surface and is soon lost. Of more recent development are the 'Panogen' and 'Mist-O-Matic' treaters. These are designed for application of liquids. The metering device in both these treaters is similar to that of slurry treater, but differ in their methods of application. The 'Mist-O-Matic' treater applies the liquid as a mist directly to the seeds. Seed treatment is usually the last step in processing and is done just before bagging.

Weighing and Bagging Equipment

8.30. Many of the seed producing firms in advanced countries are using automatic weighing and bagging equipment All the operations of weighing, filling in of bags, closing and sealing thereof are handled automatically or semi-automatically. Such machines are used not only for seeds of field crops but also for small sized packets and tins of vegetable seeds.

8.31. In the United States, the Team had an opportunity to visit several processing plants. These had varying capacities and each plant was designed and laid out to meet its specific requirements. These plants also serve as distribution centres. Production areas were scattered with a processing plant for each area where seed production is contracted with farmers in approximately 6,000 acres or thereabouts. The acreage contracted is normally within a radius of 40/50 miles. Each plant is designed to handle about 10,000 tonnes during a season. There are, however, many smaller plants which handle between 100 to 1,000 acres each.

8.32. The importance of seed processing in ensuring seed quality is fully appreciated in all the developed countries. The methods adopted for processing, the facilities of the processor and the quality of the equipment used for processing are considered so important for guaranteeing the quality of seeds sold to the farmers that the certifying agencies require as a precondition for certification of seeds that they should be processed only by 'approved' processors. Minimum requirements that processors should comply with are laid down by the certification agencies, who inspect the premises and approve the facilities after satisfying themselves that besides proper quality machinery, the processor has adequate trained staff and storage space to maintain the identity of different seed lots processed by him.

Seed Processing in India

8.33. In India drying and cleaning of seeds were until recently done by following the age-old methods of sun drying, hand picking, winnowing and cleaning. Except in respect of vegetable seeds, potatoes, jute and certain other crops, there had hardly been any organized trading in seeds. There was, therefore, no scope for the growth of any processing industry. It was only after the introduction of hybrids of maize, jowar and bajra that the importance of the adoption of modern processing techniques was realized. Seed processing technology in the sense it is understood and practised in advanced countries is of very recent origin in India.

8.34. It is only in the last few years that modern processing units have been set up with imported machines which are efficient and work quite well under Indian conditions. At the present time, approximately 80 to 90 units are in operation and these are largely utilized for processing of hybrids and wheat (high-yielding varieties) to some extent. Paddy seeds of high-yielding varieties are still being largely processed by specific gravity method, whereby light and inert material are separated by floating them off in salt water, and the good seeds are then being dried in the sun. Screens and air mills would do a more efficient and a less costly job and should be encouraged. The existing facilities are inadequate to meet even the current demands and on the basis of the projection of our requirements over the next five years, which are discussed later, these facilities need to be expanded very rapidly. Otherwise, the programme for the spread of hybrids and high-yielding varieties over the targetted area is bound to suffer.

Progress in the Development of Indigenous Manufacture and Quality of Indigeneus Equipment

8.35. The steady increase in the areas brought under the High-Yielding Varieties Programme and the growing realization of the value of good quality seeds scientifically processed and stored under proper condition have led to the growth of a large demand for more and more processing plants from seed growers and producers. This in turn has led to the healthy development of some of the local engineering firms taking up manufacture of basic seed processing equipment like driers, threshers, shellers, small and medium sized cleaners, seed treaters and moisture meters. Some of these equipment are already in use in many of the processing plants. While the development in the field of fabrication of seed processing equipment, as observed by the Team during their visit to some of these manufacturing plants, is indeed commendable considering the short period over which this development has taken place, the working, however, of some of the indigenous equipment, especially cleaners, has not come up to the expectations of many of the users. The quality of indigenous equipment for seed processing, therefore, needs to be improved a great deal.

8.36. The equipment required for the basic processing of seeds is fairly simple and it should be possible in due course to manufacture such machinery of requisite standard. There is noticeable enthusiasm among the manufacturers of processing equipment to develop this industry. Despite this, if the quality of the equipment is poor, it is largely due to the handicaps which many of them face in obtaining special types of steel and certain components required for fabrication of the equipment. Given encouragement and assistance in the import of the essential components and special quality steel required by the industry, we can look forward with confidence to the indigenous manufacturers being able to fabricate and supply standard quality basic equipment, such as driers, air-screen cleaners and seed treaters.

8.37. The discussions of the Team with some of the indigenous manufacturers revealed the need for laying down standards for processing equipment. Machinery fabricated in India are mainly being based on imported models. There is not much evidence of original designing and engineering of equipment adapted to the local requirements, though there has been some effort in this direction. This is one of the basic aspects which should receive immediate attention.

8.38. Coming to some of the specific problems of the manufacturers it was represented to the Team by manufacturers of drying units that thermostats, pressure gauge and dial type thermometers available in India do not work satisfactorily. The temperature control is an important aspect in the drying of seeds and the conditions, under which seeds have to be dried, require precise control depending upon the characteristics of the crop, temperature and humidity. If proper conditions are not established at the time of drying, the viability of seeds will be affected. It would have been observed from para 8.15 that in developed countries this aspect of seed processing receives the close attention of seed processors. The importance of having accurately functioning instruments for control of temperature and other conditions will, therefore, be obvious. It was pointed out to the Team that the foreign exchange component of these instruments may not exceed 15 per cent of the cost of driers. The foreign exchange cost of importing these components is insignificant in relation to the improvement in the quality of seeds and the resultant improvement in agricultural output.

8.39. The manufacturers of cleaners represented to the Team that their main problem stems from the difficulty in manufacturing proper screens, both in the quality of the material and the precision of the slots and holes in the screens, which is attributed to the poor quality of steel sheets available in India. In seed processing operations, air-screen machine or the basic cleaner is the most important equipment of which screens are the most vital part. Precision is needed in the separation and grading of seeds at this stage. Here again, the foreign exchange element required for the import of the right quality of sheets is estimated at 10 per cent of the cost of cleaners, but considering the improvement that can be brought about in the quality of equipment and in turn the quality of seeds, the small expenditure in foreign exchange is well worth incurring.

Projection on Requirement of Processing Equipment

8.40. A precise estimate of the requirements of seed processing equipment is difficult to make as it depends upon a number of factors like the crops to be handled, spread of the areas, harvesting period, capacity of the machines, model used, efficiency of utilization and other factors. However, a general appraisal can be had from the total quantity of seeds required to be processed. The total requirements of seed for sowing the entire area with major crops have already been estimated. These seeds would, however, be mostly used in the decentralized areas and districts and cannot be processed by modern plants. What can be said at the moment with certain measure of certitude is that the hybrid and other high-yielding varieties' requirements under the High-Yielding Varieties Programme of the Government would require to be processed and is likely to be processed with modren processing facilities as the desired response can be obtained only if seeds of assured quality are used. Total requirements of seeds of the high-yielding varieties to cover the Government' targets of 60.00 million acres by 1973-74 have been estimated as under :—

	Target 1973-74 (million acres)	*Seed rate (Kgs/acre)*	*Seed requirements (Tons)*
Paddy ..	25·0	10	*62,000
Wheat ..	15·0	40	*120,000
Maize ..	5·0	6·5	32,000
Sorghum ..	8·0	4	32,000
Bajra ..	7·0	1·5	10,000
	60·0		256,000

**Note.*—Assumes seed change-over once in every four years in the case of paddy and once in every five years in the case of wheat.

To process approximately 300,000 tonnes of seeds, we may require about 300 plants on the assumption that about 1,000 tonnes can be processed at each plant. In making this estimate, we have to keep in mind that some plants are likely to be larger than the capacity estimated above and some may be smaller. But in any case in the absence of the capacities of different types of plants that are likely to be installed, planning on the basis of 1,000 tonnes capacity per year unit would seem to be a reasonable method of estimating the requirements.

8.41. All the 300 plants are not likely to be operated at optimum capacity as this would require a steady flow of raw seeds which will not be true in the initial stages. A 25 per cent increase in the number of plants should, therefore, be provided to cover any short utilization of capacity of the plants. Further the demands for hybrid and other high-yielding seeds will not be confined to the high-yielding varieties programme. There would be demand from other areas also. Provision for the same should also be made by increasing the number of processing units by another 25 per cent. It would be safe to put the requirements at 450 plants rather than 300 referred to earlier. As against this requirement, the total number of processing plants presently established in the country is of the order of about 85. Most of these plants are also not fully equipped. Many of them do not have good dryers and some of them do not have satisfactory cleaners. All the existing plants have to be improved and additional plants have to be established in order that there may be at least 350 good plants operating in the entire country by 1969-70 and 450 plants by 1972-73.

8.42. The processing plants estimated above may be said to constitute only the beginning of the efforts in this direction. In due course, modern processing techniques have to be applied to all the crops and varieties and to most of the cultivated area in the country and cannot be confined only to special Government programmes like the high-yielding varieties programme. There is need for considerable experimentation and study in regard to the types of processing equipment to be used and sizes and locations of processing plants. There is need for developing a larger number of types of processing plants than what is envisaged in para 8.41 above. If the entire seeds produced in the country are to be processed by modern processing techniques, the total requirements of processing plants in terms of average capacity envisaged in the previous para will be more than double the figure indicated above.

8.43. The facts and estimates made above clearly indicate the need for—

(a) Long-term measures aimed at developing sufficient indigenous capacity to meet the ever-increasing demand for different types of processing equipment that would arise in the course of the next decade ; and

(b) Short-term measures designed to meet the immediate requirements of high quality seeds for the high-yielding varieties and other programmes that are being taken up by the Government and other sectors.

8.44. Keeping in view the various difficulties being experienced by seed producers as well as by the existing seed processing equipment manufacturing concerns, the Team feels that a definite policy should be formulated as recommended below and given effect to for achieving the long-term and short-term objectives mentioned above.

Steps to be taken to achieve the long-term objectives

8.45. The general impression of the Team is that the Indian equipment manufacturers are in due course capable of producing most types of equipment needed for the future development of seed industry in India. We have already pointed out that there is need for pursuing a policy of encouraging such manufacturer to develop indigenous capacity. However, an industry of this type cannot be allowed to take its own time to develop in the normal course as the production and distribution of seed is of crucial importance to the community in the present state of our economy. Special steps must be taken for encouraging the manufacture of high quality seed processing equipment, designed especially to suit the needs of the seed producers in India. There is no doubt, that considerable knowledge and technology are to be obtained from foreign countries, but unless these are adapted to our conditions, we cannot make the best use of the same. There is an urgent need for a strong and well-staffed Engineering and Design Organization which should devote itself exclusively to the study of the problems of processing of different seeds, the types of equipment required, the specifications thereof, the problems of manufacture of such equipment and provision of requisite assistance and advice in this regard. Such an organization would have three distinct functions :—

(a) Research and Survey

(i) Research into the problems of seed processing keeping in view the average quality seed lots that are harvested and the requirements of seeds to be used by farmer

(ii) Research in designs and manufacturing equipments, and

(iii) Studies in design and building, and economics of seed processing plants.

(b) Advisory services and assistance to producers.

The seed producers should be in a position to refer any problem on seed processing which they may face to this organization and obtain authoritative and competent advice on the best method of solving the problems, which they face in respect of processing. The organization should also provide them on request, blue-prints on seed processing, flow charts and advice on procurement of quality equipment. For sometime to come, it may also be necessary for the organization to purchase and stock quality equipment and spare parts thereof to supply to seed producers.

(c) Advice and assistance to equipment manufacturers.

Such an organization should be in a position to assist existing and prospective manufacturers in the development of new and better models and in perfecting their existing equipment. The organization should provide blue-prints and proto-types and also testing facilities for the development of such equipment. They should also be able to arrange for the supply of components of other raw materials that may be required by manufacturers for the development of quality machines especially when such components or raw materials are not easily available.

8.46. In our view the most appropriate agency for undertaking the above work on seed processing equipment and provision of assistance to seed producers and machinery manufacturers would be the National Seeds Corporation which has already a cadre of engineers who have assisted in establishing various processing plants and have also the experience with the batch type system of seed processing. A Seed Technology Division in the Indian Agricultural Research Institute has been proposed and with its establishment and development, it can be of considerable assistance to the National Seeds Corporation which can work in collaboration with the same. The Seed Technology Division would be undertaking basic types of research in improving the viability, vigour and purity of seeds and the effects of various systems of drying, seed treatment etc., on the quality aspects of seeds. The Research and Design Organization of the National Seeds Corporation on the other hand, would concentrate on development of newer types of machinery and better systems of processing applicable on a field scale and will utilize the results of researh emanating from the Seed Technology Division of the Indian Agricultural Research Institute, One of the major functions of the Seed Technology Division and the Organization proposed above would be the provision of training courses. The course may be open to equipment manufacturers and seed producers. It is recognized that the seed processing equipment alone may not provide adequate volume for the development of a new industry especially if separate firms specialize in separate items of equipment like cleaners, dryers etc. The difficulty may be got over by firms taking up the manufacture of the whole range of equipment required by the seed industry. Alternatively many of the equipment similar to those required by the seed industry are also required by other industries. Cleaners and dryers are needed both by the grain industry as well as by the seed industry. Moisture meters have a wide range of application. It is possible for the companies manufacturing the seed processing equipment to diversify into the allied fields and in fact, in the case of moisture meters and bag closers this has already happened.

8.47. An industry manufacturing quality seed processing equipment will not, however, develop unless the existing and other prospective manufacturers are reasonably certain of the development of effective demand in this field. One of the major limitations in the development of the demand is the doubt in the minds of the buyers in regard to the quality and reliability of the equipment that are locally made. If a central agency undertook the responsibility of checking and ensuring quality, the demand for equipment may increase rapidly. Further, planning of production and manufacture of equipment can be done better if the orders for various equipment are consolidated and placed well in advance. The placing of orders by various seed producers, State Governments, etc. on an isolated basis on a large number of companies may not lead to healthy development in the manufacture of seed processing equipment as the total number of seed processing equipment required over the course of next few years is not likely to be of a very large magnitude. A few selected enterprises specializing in the manufacture of seed processing equipment would offer the best possible method of developing quality machines. The Team, therefore, recommends that the National Seeds Corporation which has the objective of development of seed industry in the country, should act as a general agency for placing advance orders on selected firms for the manufacture of different kinds of seed processing equipment and should in turn supply these equipment to the seed industry.

8.48. In placing orders for manufacture of seed processing equipment undue emphasis should not be laid on tendering procedures designed to emphasize the cost aspect of the machine vis-a-vis the quality aspect. Under the normal Government procedures, it is customary to select the lowest tenderer so long as it is felt that the machine offered by the lowest tenderer will do a satisfactory job. It is not the practice to obtain better quality machines at a higher price unless it is felt that the cheaper offer will not serve the purpose. Such an approach will not help the development of a new industry where considerable experimentation has to be encouraged. The orders must be placed on those firms which have requisite facilities and, therefore, every reasonable prospects of making good quality machines. When a public sector undertaking acts in the above manner, it may be misconstrued as favouring certain parties and there may be hesitency in adopting a bold policy designed to encourage manufacture of quality machines on account of these possibilities. The consequences of any such hesitation would be slow or inadequate development in indigeneous equipment manufacture which in turn will lead to either lack of processing facilities or a continued reliance on imports. It should be possible for a public sector undertaking to take all these circumstances and facts into account and devise a policy that would be free from the type of hesitation referred to above. Further the National Seeds Corporation would be purchasing equipment for the use of other seed producers, State Governments etc. They have, therefore, to be governed by what their customers in turn require and if the customers' preference is for higher quality machines, even at a higher cost the extra cost has to be incurred on behalf of the customers.

8.49. A numer of firms manufacturing seed processing equipment in the advanced countries like the United States and Europe have developed their expertise over a number of years. It was noted that in one of the manufacturing firms most of the employees had an experience over a considerable length of period. It would be extremely useful if the engineers incharge of the manufacture of seed processing equipment could be sent on a study tour to such firms in foreign countries. They should also visit institutions like the Mississippi Seed Technology Department where they could be given special training and orientation in the requirements of seed processing equipment.

Steps to be taken to achieve the immediate objectives

8.50. Even if all the recommendations made in the preceding paras are implemented immediately and full encouragement is given to the indigenous manufacture, it may take a year or two before the results are evident in the shape of easy availibility of quality machines for seed producers. In the mean time, the present state of extreme inadequacy of processing facilities cannot be allowed to continue. The agricultural production programmes in the country lay heavy emphasis on the use of highly-fertilizer-responsive varieties and unless high quality seeds of these varieties are available, the desired response may not be achieved and there may be a set-back to the entire programme. Unless processing facilities are adequate, it would not be possible for any agency to ensure the requisite quality of seed which alone can build the confidence of the farmers and help the further extension of work that is expected of the various public agencies.

8.51. We have already reviewed the present availability of processing plants and noted not only their inadequacy in numbers but also their deficiencies in particular types of equipment. The only solution to overcome these deficiencies is to allow a liberal policy of imports to overcome the specific problems being faced by the seed producers in the different parts of the country. The most critical shortage of the equipment are examined below :—

(a) *Seed Cleaners.*—The consensus of opinion in the country was that the small and medium sized indigenous cleaners are far from satisfactory. Recognizing this, the Government have already allowed to import a number of seed cleaners of different models. It is necessary to continue this policy and we recommend the import of seed cleaners required to meet the processing facilities over the next two years. At the same time, it would be advisable to import the screens of different sizes and specifications and supply them to manufacturers of seed cleaning equipment as the non-availability of good screens has been noted to be a limiting factor in the manufacture of quality equipment. The foreign exchange reqirements to cover these imports are not likely to exceed Rs. 50 lakhs.

(b) *Seed Dryers.*—Though a number of dryers have been manufactured in the country and these are not as unsatisfactory as the indigenous seed cleaners are, they nevertheless suffer from a serious deficiency in the sense that there is no automatic control of temperature. The imported equipment used in the country provide for automatic cutting off of ignition when the temperature exceeds certain points and automatic re-ignition when the temperature falls below a certain minimum. Both these controls are very necessary as the seed may get spoiled either if the temperature exceeds maximum limit or if the temperature is allowed to fall below the minimum limit for if the temperpture is allowed to fall below the minimum limits as in the latter case the seeds may be prolonged in drying and mould may develop and in the former case the germination may be destroyed by excessive heat.

The Team recommends the import of automatic control devices like thermostats and automatic re-ignition devices. The foreign exchange require ments for this purpose are not likely to exceed Rs. 5 lakhs.

(c) *Bag Closers.*—To ensure that the seeds are of high quality and are not adulterated, it is necessary to provide for an effective bag closing and sealing of seed bags. Bag closing equipment of a suitable type are not being manufactured within the country, but the Team got the impression that the manufacture of this equipment would not be difficult if some of the larger companies who are interested in sewing machines take up this item of work. Also, it is understood that if certain components are imported, even smaller units would be able to make a satisfactory job. It is recommended that whatever facilities are required, should be provided and adequate number of bag closing machines should be got manufactured within the country. If this is not possible a liberal import policy may be adopted for import of such machines. It may be mentioned that bag closers are required not only by seed firms, but also by fertilizer firms and other industries where prevention of adulteration is an important aspect. Foreign exchange required to import bag closers for the seed industry over the next two years will not exceed Rs. 5 lakhs.

(d) *Specialized Equipment.*—The seed processing equipment used in the country are still the most elementary types. A number of better and newer types of equipment are being used abroad. For certain crops like grasses, fodders and vegetable seeds, the use of such equipment is very essential for the production of quality seeds. The Team recommends that the import of specialized types of seed processing equipment like specific gravity separators, aspirators, automatic weighing and bagging machines, cylinder separators, sizing equipment and special types of driers should be allowed as experimental measure and the use of such machines should be encouraged. It may be mentioned that the import of these machines is not likely to be on a very large scale as there may not be many applicants who would readily come forward to import such machines. Foreign exchange requirements will not exceed Rs. 30 lakhs.

(e) *Spare parts.*—A number of seed processing equipment have already been imported in the country and some have been obtained under Aid Programmes. It is necessary that these equipment as well as those that may be imported in the near future are maintained in full working condition. Sufficient spare parts should, therefore, be imported along with new machinery. For existing machinery, which have been already used for a long time, there is need for import of spare parts as the stocks obtained with the initial import would have been exhausted. The Team is aware of Government policies of giving priority to maintenance imports. The Team recommends that the existing plants should be kept in full working condition by the timely and liberal import of spare parts required.

Management and Training in Processing Plants

8.52. The provision of good quality machines for seed processing is of vital importance, but equally it is important to have good management practices in processing plants. Good management will ensure proper planning and detailed attention to all aspects of seed processing to ensure the highest quality. It can avoid costly errors in sorting, cleaning, drying or treatment. Errors at any of these stages may result sometimes high spoilage of seed adding to the costs of production. A number of decisions will have to be taken and unless there are competent personnel employed in a processing plant, the requisite decisions may not be taken in time. Further the utilization of both manpower and machines will have to be given special attention to achieve optimum efficiency. From all these view-points it is necessary to select good personnel for the management of seed processing work and provide them adequate training within the country as well as abroad.

Location of Seed Processing Plants

8.53. The location of seed processing plants should be decided by each agency which may decide to set up the processing plants keeping in view the likely long-term seed production potential in different areas. By and large, processing plants should be located near the production areas rather than in marketing areas as it is safer and easier to transport processed seeds than the wet unprocessed seeds harvested from the farms. The agencies who would be setting up seed processing plants would normally be (i) growers' organizations, (ii) co-operatives dealing in seed production, (iii) private firms and companies dealing in seed production and (iv) commercial organizations of Government. Ordinarily, it should not be necessary for the Government to establish seed processing plants except where the other agencies listed above have not come forward after adequate encouragement to establish such processing plants and lack of processing facilities is being experienced. The need for Government's setting up processing plants would arise only in case Government enters seed production and marketing on a large scale. If Government is not entering the field of seed production and marketing, it may confine to the establishment of processing plant only to such areas where other agencies do not come forward to establish the same and even in such areas, the Government plants should be handed over as soon as another agency is ready to take over and operate them.

8.54. Packages for seeds are not mere containers but should have a capacity to retain the seeds with their original qualities. Very dry seeds with 3 per cent to 8 per cent moisture content kept in moisture-proof containers retain their viability and vigour in various conditions of temperature and humidity. Moisture-proof packaging, therefore seems to be the most economical way to maintain the quality of processed seeds.

Packages should have sufficient tensile strength, berthing strength and tearing strength to withstand the normal handling procedures. Usually, materials used for packaging just as gunny bags, cloth bags etc., do not have moisture protecting qualities or they are otherwise suitable. Packages for processed seeds in foreign countries are made of burlap jute, cotton cloth, paper, films, metal, glass, fibre board and various combinations. Jute and cotton bags can be laminated with other materials like polyethylene. Paper products are extensively used for packaging seeds. A typical paper stock for small bags has a basic weight of 75 lbs. for 500 sheets (25″ × 38″). The advantage with paper bag is that attractive printing is possible. Many paper seed bags have multiple plies or layers. The kraft paper used in them has a basic weight of 40 to 50 lbs. for 500 sheets (24″ × 36″). Aluminium foil has a low moisture vapour transmission rate even for thicknesses less than 0.0015″. Further, aluminium foils can be bonded to other materials to produce combinations having desired characteristics. Polyethylene is widely used for seed packaging. Polyethylene is an extensively used thermoplastic film. Conventional low density films have been considered better for seed packaging than medium and high density films because of differences in bursting and tearing strength and stretch. But it is reported that a polyethylene film of medium density (specific gravity 0.938) has been developed that surpasses the performance of conventional polyethylene. Metal containers properly sealed provide an absolute barrier to moisture and gas and shield the product from light. They provide complete protection against rodents, insects, changing humidity and harmful fumes. They can also easily be seen automatically and quickly. Care has, however, to be taken to ensure that seeds are properly dried before they are packed in metal containers. The choice of packaging media for a given purpose depends not only on the initial moisture content of seeds but also on environmental conditions to which these packages are exposed during storage and marketing. It also depends on bulk density and the size of pack for a good weight. The relevant costs of various packaging materials as given by the Indian Institute of Packaging, Bombay, may be seen in the table below :—

Serial No.	Capacity in volumes	Packaging material	Approximate cost*
1	Over 18 litres	Polyethylene lined jute bags	Rs 2.00 for a size of 20″ × 44″
2	For 18 litres	(a) Rectangular tins of capacity 4 gallons (lid on type)	Rs 4.15 to 4.25 per tin.
		(b) Rectangular tins of capacity 3 gallons (lid on type)	Rs 3.60 to 3.65 per tin.
3	For 10 to 18 litres	(a) Polyethylene lined cloth bag	Rs 2.00
		(b) 3 ply multiwall paper sacks (80 gms. imported kraft paper)	Rs 1.40 to 1.50 for a size of 36″ × 21½″
4	For 5 to 10 litres	500 gauge Polyethylene bag (gussetted)	Rs 0.40 to 0.45 for a size of 12″ × 8″ × 1″
5	For 1 to 4 litres	(a) Cans of size 700 × 800, 3 colour printing (open liver lid type)	Rs 250.00 per 100 cans.
		(b) -do- (Plain)	Rs 240 per 100 cans.
6	For 1 litre	(a) Cans of size 404 × 504, 3 colour printing (open liver lid type)	Rs 100.00 per 100 cans.
		(b) -do- (Plain)	Rs 94.00 per 100 cans.
7	For less than 1 litre	(a) Printed Polyethylene bags	0.15 to 0.30 } Depends on size and gauge of material used
		(b) Aluminium foil laminated with polyethylene	0.20 to 0.70

*These figures are tentative.

CHAPTER—9

SEED STORAGE, MARKETING AND DISTRIBUTION

Seed Storage

9.1. The inadequacy of arrangements for proper storage of seeds was highlighted during the visits of the Team and during discussions with State Governments as well as with various seed producers and other parties. As part of the Plan programmes, seed stores have been constructed in many of the foundation seed farms established by State Governments and also in the various National Extension Blocks. Many co-operative societies have also established seed stores with financial assistance provided for the purpose. Storage facilities are also available at both Central and State Warehousing Corporations. Despite all these steps, the general feeling is that the storage facilities are not adequate for the handling of seeds. The reason for the same arises from the fact that very often seeds are not stored exclusively in seed godowns but are often stored mixed along with fertilizers, chemicals and other seeds. The Team cannot but emphasize too strongly the desirability of avoiding such a practice. Other seeds, etc., may be infested with weevils or other insects and these can spread the damage to the seeds and lower their viability and vigour. Also storage of certain chemicals might affect deleteriously the quality of seed. Therefore, there is need to realize the importance of storing seeds separately. Considerable educational work is necessary so that different agencies at all levels take note of careful storage of seeds which has acquired special importance in view of the provision in the Seeds Act. Under the Seeds Act and the rules framed thereunder, any person whose name appears on a packet of seeds is liable to be prosecuted, if the germination of seeds go below the levels stated on the label. Normally, the seed producer's name will be appearing on the label. The seed producer or the marketing agency has, however, very little control on the storage at the retail level. If the retail storage is poor, germination may go down below the stipulated minimum and put the seed producer or the marketing agency into difficulties. To avoid such situations, it is necessary that adequate arrangements are made for storage at the retail level also.

9.2. More fundamentally the question of seed storage has to be examined for different categories of seeds. Normally, it can be stated that there should be four categories of storage, (1) storage where a temperature of—1°C is maintained. This should be utilized for very long storage required for breeder seed and breeding material at research institutes, (b) Cold storage with temperature and humidity control where the sum of the temperature calculated in °F and the relative humidity in percent does not exceed 100. This type of storage is required for foundation seed, breeder seed and costly vegetable seeds, which should be stored for 3 to 4 years with good viability and vigour. The National Seeds Corporation has established one such storage at Delhi and is planning to establish more storages, (c) Seed storages with insulation and generally in a cool dry place with provision for control of temperature and/or humidity in times of extreme heat or moisture. Here the objective is not to maintain a uniform level of 100 as in the case of category (b) but rather to control humidity or temperature, as and when need arises to the extent that is desirable. This type of storage will be required for maintaining carry over stocks of certified seeds from season to season. (d) Finally there is the ordinary cool dry storage where seeds are to be stored for a period not exceeding six months. Such stores will have to be constructed to ensure that the interior is cool and dry and the space well fumigated. These stores will be both at the processing plants and district level as well as at the retail level.

9.3. In addition to the construction of the seed storage house, it would be necessary to ensure that sound practices are followed in the storage of seeds. Seeds should be so arranged as to cause minimum difficulties in the location of particular lots. There should be no mix up of lots in storage. This is especially important in respect of foundation seeds. The people incharge of storage should be conversant with the measures to control storage diseases. Regular plant protection measures must be taken and the seeds should be methodically fumigated. The services provided by the Plant Protection Directorate and CFTRI should be utilized for training of personnel in these matters.

9.4. In this connection it may be pointed out that there are a number of potato cold storages in the North Indian plains. Additional cold storages are also being put up with the assistance being provided by the Central Government and the National Co-operative Development Corporation. Potato cultivation is, however, being taken up in new areas under the seed plot technique evolved by the Central Potato Research Institute. It would be desirable to build cold storages in these areas also. Further, it should be examined whether part of the potato cold storages cannot be converted into cold storages useful for maintenance of seeds by providing humidity control which would normally be absent in a potato cold storage.

9.5. Besides providing proper storage facilities, careful drying and bagging of seeds will preserve the viability and vigour of seeds. The Team recommends that facilities should be developed for drying of seeds, if necessary upto 5 per cent and their proper canning. This system should be adopted especially for foundation seeds and vegetables.

Seed Distribution and Marketing

9.6. The production of high-quality seeds is important, but if they are not marketed properly and used by the farmers, the value of the production is lost. The transfer of the seed from the producers to the farmers, i.e., marketing of the seeds is a vital link in the seed industry. Distribution and marketing may seem a relatively simple process where the farmer purchases directly from a seed producer, but in reality the mechanism of distribution and marketing is much more complex and needs to be integrated with a sound production porgramme.

Systems Obtaining in Advanced Countries

9·7. In most of the countries visited by the Team, the farmers are serviced by a well-developed seed industry in the private sector working under competition and supplying high-quality seeds to the farmers. In Japan the distribution of seeds of paddy and other important crops is handled by prefectural and national co-operatives and the entire seed distribution system has some element of subsidy by Government. In respect of vegetables the seed distribution is being handled by private seed companies where no subsidy is involved. In Sweden, the trade is largely in the hands of private firms and distribution is effected through farmers' associations, wholesalers and retailers. Co-operatives and farmers have played a leading role in building up the seed marketing systems in Sweden. In the United Kingdom and the Netherlands also, marketing and distribution of seeds is predominantly done by the private sector. A good part of seed production in the Netherlands is export-oriented. In the U.S.A., a fair amount of the trade in seeds is handled by the growers' co-operatives but the bulk of the trade is handled by the private sector. Companies range in size from very large companies, operating throughout the U.S.A. and in other foreign countries, medium-sized enterprises with operations confined to a few States in the U.S.A., small companies operating just within a State to small groups of farmers growing and selling seeds. The larger companies have an integrated organization with a well-developed research and breeding programme, principally concentrating on hybrids. The marketing organization and techniques vary from company to company in detail but follow a pattern which is broadly similar. In general, in marketing operations, there is the active participation of farmer-dealers wholesalers and retailers. There is a distinct preference to operate through farmer-dealers, as such a system has been found to help in gaining quick farmer acceptance. Advertising and promotion are done on an extensive scale and the expenditure on this account works out to well over 5 or 6 per cent of sales. These companies operate in a free market under highly competitive conditions. Under these conditions, the main emphasis is on quality which ensures an adequate price level and return on the investment. This provides them sufficient margin to develop and expand their activities. Financing of operations is done by raising the capital from share-holders, loans from banks and other commercial channels, which is freely and liberally available.

Seed distribution and marketing in India—Present Status

9·8. There are five types of seeds distribution obtaining in India which may be briefly summed up as under :—

(a) *Farmer to farmer distribution.*—This is the traditional method whereby farmers obtain their requirements from neighbours either on cash payment or on exchange basis.

(b) *Registered grower distribution.*—Many State Governments distribute foundation seeds to registered growers, but do not plan or undertake procurement. The registered growers are expected to distribute the registered seed to farmers on cash or exchange basis. This is similar to the farmer to farmer exchange.

(c) *Distribution by Co-operatives.*—This may be procurement of seeds by Co-operatives and its subsequent distribution or it may be exchange of seeds on sawai basis. The latter is disappearing generally. The distribution of seeds through Co-operatives has been encouraged through subsidies and guarantees.

(d) *Distribution by Departments of Agriculture.*—Seeds are purchased by the Government out of the Government funds and are distributed through District Agriculture Officers and Block Development Officers. This system of distribution is widely adopted.

(e) *Distribution of seeds by Non-Government or quasi-Government agencies.*—This has generally been confined to vegetables, jute, potato and green manure seeds. Recently, direct distribution of hybrid seeds and seeds of high-yielding varieties direct to farmers has developed to some extent.

9·9. There has always been private seed trade in vegetable seeds, potato seeds, green manure seeds, jute seeds and a few other seeds. There have also been a number of nurseries selling horticultural products. However, the State Departments of Agriculture are playing a major role in the seed marketing

India. The distribution and marketing of all imported seeds, seeds produced by the State Farms and the National Seeds Corporation and seeds procured on the basis of State policies is carried out by them through the departmental depots and Co-operative Societies. Most of the new hybrids and seeds of high-yielding varieties are channelled according to the Government policy into the H.V.P. areas along with fertilizer supplies. In these States, where the departmental marketing and distribution is not on a large scale, distribution by the private trade has developed. It is, however, to be noted that the bulk of the production of raw seeds is done by a large number of farmers growing seed for seed firms, State Governments or the National Seeds Corporation. Though the seed firms have organized large production through contract growers, they have not yet been in a position to develop their own marketing organizations.

9.10. The reasons for the relative lack of development of seed marketing by the private seed growers are not difficult to seek. Traditionally, the farmer has been largely independent in terms of his inputs, such as seeds, fertilizers, farm implements, etc. Normally, sowing is not made specifically for seed production, a portion of the over-all production of the crop of the farm being retained by the farmer for use in the following season. In some cases good farmers may do a limited selection in order to get a desired type or improved quality from the overall production, and may improve their seed in terms of quality and yield potential. However, under these conditions there was very limited scope for crop improvement. Such a situation hardly provided any scope or demand for a marketing system to develop. Only in respect of vegetable seeds, potatoes, jute and certain other crops private trade had developed in the past. However, over the last few years, as a result of the rapid advance in the methods of research and development of varieties or hybrids with a potential for high-yields, agricultural practices have undergone a revolution. Agricultural scientists have provided the farmers with varieties and hybrids that give high yields and have assisted them to move from the traditional to the modern method of agriculture, where the farmer finds it profitable to use other inputs of modern agriculture—fertilizers, better farm implements and better soil, crop and water management. This change in situation has made it necessary for the farmer, instead of obtaining seeds in the traditional way, to look to other sources for several reasons. In the case of hybrids, such aspects as isolation, experience in seed growing and attention to cultural practices have made it impossible and uneconomic for most farmers to grow their own seed. With self-pollinated improved varieties, they may find it satisfactory to produce their own seed along with the normal production of the crop. In such cases too, the farmer may find that mixtures occur after a few seasons and replenishment with genetically pure stock is needed. Also when new varieties are developed, the farmers will wish to discard the old variety and obtain the new one only. In other words, with the continuing impact of research in plant breeding and other technological changes taking place in Indian agriculture, like increased fertilizer supplies, availability of more water for irrigation a situation has been developing, where there is a continuously growing demand from farmers for high quality seeds of new varieties.

9·11. While these changes in circumstances undoubtedly provide an opportunity for entrepreneurs to undertake production and distribution of improved seeds at the wholesale and retail levels, the food situation in India in the last few years had demanded of the Government the launching of a crash programme for the production and marketing of improved seeds, to ensure the success of the High-Yielding Varieties Programme. The National Seeds Corporation, a wholly owned Government of India undertaking was established in 1963. The objectives of the N.S.C. include the development of the seed industry in India on healthy lines, by providing technical guidance and training for seed growers. During the past 5 or 6 years considerable progress has been made and the N.S.C. has undoubtedly performed a very useful function. It has contributed a great deal to spreading interest and fostering production of processed seeds, when the country was facing the formidable problem of providing quality seeds and stimulating interest in food production on a large scale. With the N.S.C. playing the leading role, the State Departments of Agriculture became closely involved with the tasks of supervising the production and organizing the distribution of seeds of hybrids on a large scale.

9·12. On the whole the National Seeds Corporation and the State Departments of Agriculture have done a good job of distributing seeds to the farmers. The high goals set for the future will, however, require a massive expansion of seed producing and distributing units. The magnitude of the problem is such that it is inconceivable that this responsibility should continue to remain with the departmental agencies. The seed industry, as in the case of most industries, has several aspects, which include research, production, processing, quality control and marketing, all of which are inter-related. In a well organized seed industry, it is important that each sphere of activity is given due attention and secondly coordination is achieved in the various spheres. Both the public sector institutions and the private sector have important roles to play in the seed industry. The public institutions are directly involved in research development and maintenance of quality standards. Central and State Agricultural Departments and institutions have important functions to perform in the education of farmers through their extension agencies. In the recent past, more out of necessity than as a result of any deliberate policy, distribution was also undertaken largely by the Agricultural Departments and by the Block Development Officers. The primary task of marketing is the creation of a new demand and balancing of supply with the demand. A dynamic marketing organization must keep constantly in mind the needs of its customers—in this case farmers— and satisfy those needs, both in respect of quality and quantity, in a satisfactory manner. Such an organization will also increase the pace of spread of new varieties by sales efforts, adopting scientific techniques of sales promotion. By meeting the demands of farmers satisfactorily and making their preferences known to the agricultural scientists, the marketing agency would not only be performing a very useful service by helping to increase the agricultural production, but it will also make agricultural research oriented to the farmers' needs through the market mechanism. Considering the goals set for the future, which will have to be achieved within a short period of time, the development of dynamic marketing is, undoubtedly, called for.

9.13. There is, therefore, a great and urgent need to initiate a process of development of co-operatives and private seed marketing and distribution. The Team was happy to find such development has already begun to take shape in some States. A policy to encourage such development should be adopted and, as this develops, the departments should reduce their activities in this field and concentrate and intensify in their more important extension functions.

9.14. The following issues arise in this regard :—

(a) Whether there is need and scope for the development of a private seed industry in the country with its own arrangements for marketing and distribution.

(b) Despite the fast expanding market for seeds, as a result of the growing consciousness of the Indian farmers to take to the use of processed seeds of improved varieties, why has not the private industry developed in the field of marketing and distribution of seeds ? and

(c) If there is need and scope for developing a private seed industry, what measures are to be taken for the development of such an industry ?

9·15. The seed industry has not been specifically reserved for the public sector under the Industrial Policy Resolution of the Government of India. It has been the policy of the Government of India as well as the State Governments, generally, that the extension agencies should not be burdened with supply functions. The Agricultural Department staff as well as the staff of the Block Development Offices had been in the past taking up supply functions like distribution of fertilizers, seeds, etc., more out of necessity than as a result of deliberate policy. It is, therefore, in keeping with the general policy of the Government to encourage alternative sources of distribution so that the Government funds and personnel need not be involved too deeply in these functions and can devote more of their attention and time on the extension education. With the introduction of hybrids, the need for renewal of the hybrids every season to reap the benefits of the hybrid vigour and to supply the seed needs of cultivators on an annual basis would require the development of a well organized system of seed production, processing and distribution over such a large acreage that the bulk of it would have to be provided by the land owners. Technical skills required for hybrid seed production are such, that not every cultivator can produce his own seed. The annual requirements of hybrid seeds are of such a large volume that specialized equipment is necessary for handling the seed crop from the stage of planting to ultimate sale to the consumers. To justify the expense of such equipment, large operations are necessary, so that the cost per kilo of seed does not become unduly prohibitive. The size of the seed market, the areas to be brought under seed production and the processing facilities required to handle the production needed to reach the goals set for 1973-74 have been discussed earlier. As the demand for seeds grows at this fast rate, unless a sound marketing and distribution system develops in all areas, imbalances between supply and demand may arise creating difficulties for the growers, and cause a setback, to the agricultural programme. It is, therefore, quite important that the Indian seed producers, build up their own marketing organization and acquire their own appreciation of market developments for individual areas and varieties, based on their own intelligence data rather than on Government targets for seed distribution. Many progressive Indian farmers are today willing to purchase seeds of high-yielding varieties of good quality at prices that would cover the costs of growing, processing and distribution, which indicates that there exists in the country a strong market for processed quality seeds. Its nature is sophisticated and the overall seeds market is likely to grow at a fast rate and become complex in terms of the number and types of varieties the cultivators are likely to demand. The situation is favourable to the development of a healthy seed industry and it is essential to recognize the importance of stimulating the growth of a private seed industry to secure the rapid and extensive growth of agricultural production.

9·16. We may now proceed to examine why in spite of a favourable situation having emerged with a strong market for processed quality seeds, which can command good prices, the private seed marketing has not developed adequately. In our discussions with the various State Governments and others, a number of reasons were indicated and these could be summarized as under :—

(a) Lack of capital to invest in processing equipment and for setting up a marketing organization;

(b) Individual producer's production is on such a small scale that it would not justify investment in plant and machinery and in setting up a distribution organization;

(c) Lack of faith on the part of some of the farmers in the quality of production of the private producers;
(d) Charging of exorbitant rates in times of scarcity;
(e) Ceiling on land holdings, which restricts the scale of production and makes it difficult to secure isolation distances for the seed crop;
(f) Procedural difficulties in inter-State movement of seeds; and
(g) Lack of awareness by the seed producers of the potential of the growing seed market.

9·17. During discussions with the State Governments, the specific question was raised whether the present margin between the retail prices of processed seeds and prices paid to growers provided adequate incentives for—

(a) production of seeds ;
(b) distribution and storage ; and
(c) wholesale and retail marketing.

With the exception of some States, the other States indicated that the prices paid to the growers provided adequate incentive for growing. The majority of the States, however, indicated that the margin available is inadequate to cover the costs of distribution. The views elicited from the seed producers also clearly indicated that the margin between the retail prices and prices paid to growers was insufficient to cover processing, distribution and storage costs and to allow for accumulation of reserves for expansion.. In their view, it is this factor which makes it difficult for private producers to actively participate in the distribution and marketing of seeds of high-yielding varieties to cultivators.

9·18. It would be seen from the above that, if marketing by the private seed industry has not developed despite the strong market that has emerged in recent years for such development, it is due to a combination of factors, but principally due to the low margins of profit for marketing and distribution functions. As early as May, 1966, it was decided at a Chief Ministers' Conference that the policy of keeping the prices of seeds to farmers at unrealistically low levels should be reversed and that the price for processed and certified seeds for sowing purposes should cover the cost of processing, including interest and profits, cost of distribution and marketing and a proper incentive to seed growers. This policy is still to be implemented in all the States with the result that the market is now characterized by satisfactory prices to seed growers, but poor margins to cover marketing and distribution costs, which provide insufficient incentive to the seed industry to build up a marketing and distribution organization capable of providing good service to the farmers.

9.19. As has been stated earlier, the State Departments of Agricultural have been playing a major role in the distribution of seeds. In the initial years of introduction, it is understandable that the Government might have found it necessary in order to induce farmers to take to cultivation of hybrids and high-yielding varieties to maintain low levels of prices through direct or indirect subsidies This situation no more exists, as farmers are now aware of the value of good seeds and would be prepared to pay prices that are considered economical to the seed grower and to the seed firms. It must be emphasized that the cost of seeds compared with other inputs forms only a small fraction of the farming costs. The increase in the farming cost involved in switching over from traditional sources of supplies to processed quality seeds of new varieties, particularly in areas of assured irrigation and good drainage, is only marginal and forms a small fraction of the ultimate increase in output. Many progressive Indian farmers are ready to pay the price for good quality seeds of outstanding varieties and of hybrids. Given adequate credit facilities, the level of prices of quality seeds would not be a constraint on demand. The real demand constraint will be quality rather than price. The other factors that can influence the price level of seeds are adequate credit facilities and availability of complementary inputs, such as fertilizers and pesticides and as long as these inputs are available in adequate quantities, there will not be any adverse effect on potential seed prices.

9.20. Let us now examine the problem from the growers' and seed producers' angle. Farmers' decisions to grow a seed crop or a commercial crop are governed by factors, such as his skill and ability, quality of his land, availability of water resources, finance and possibility of ensuring isolation distances in the case of hybrids. Even if all these conditions are ensured, the farmer is influenced only if the relative income from growing a seed crop is higher than the income from a commercial crop and provides adequate incentive to compensate the other costs to be incurred for growing a seed crop, such as (a) cost of foundation seeds, (b) isolation costs, where necessary, (e) detasseling or roguing expenses, (d) certification and field inspection services, (c) extra harvesting costs and (f) seed drying expenses. In the initial stages of implementation of the High-Yielding Varieties Programme, it became necessary to organize seed production on a very large scale within a short period. A large number of farmers had to be persuaded to take up seed production of hybrid crops, though they lacked experience. In hybrid seed production, the yield per acre is generally low, growing techniques a little difficult and the risks much higher. It is therefore, understandable that in the initial stages the Government had to offer a high premium to grow these crops.

However, over the last two years, seed production has expanded and with the considerable experience gained by the farmers yields have steadily gone up. With the increase in yields, there is a trend towards diminishing costs of production and this trend should place the seed industry in a favourable position to buy raw seeds at reasonable unit prices.

9.21. In order to establish a fair retail price, apart from the purchase price of raw seeds, it is also necessary to take into account the costs incurred by a producer for processing of seeds. Such items include—

(a) Seed drying expenses;
(b) Seed processing and sizing costs;
(c) Seed treating, bagging and handling expenses;
(d) Cost of bags, tags, seals, etc;
(e) Risk involved (not less than 10 per cent of the cost of process ed seed depending on the kind of seed involved);
(f) Depreciation on building, equipment and other facilities necessary for quality production; and
(g) Interest on investment.

In addition, warehousing, research, sales and distribution costs should be taken into account. Provision must be made for bad debts, repairs and maintenance of processing machinery, dealer commission, loss of seed due to obsolescence or deterioration and overheads. Unfortunately, there is a mistaken notion that margins comparable to those obtaining in the grain trade should be adequate. It must be pointed out that the grain trade handles very large quantities that are practically sold every day and do not involve several of the factors mentioned above. The quantum of money needed for investment is low in relation to the total turnover as money is turned very fast. Further, there are hardly any risks in the grain trade either in terms of prices or in terms of deterioration or lack of markets as in the case of seeds. It is, therefore, felt that private industry will develop as soon as reasonable margins are available.

9.22. The question, therefore, arises as to what steps are to be taken to achieve this object. While it is necessary to set the retail prices at a level, that would cover adequately the production costs, an increase in the retail price may result in slowing down the pace of spread of hybrids and other high-yielding varieties. At the same time there is need for adequate margin for development of an effective seed distribution system. Fortunately, the factors which we have already pointed out above indicate that the yields of seed per acre are consistently going up and this fact along with certain other measures being considered below should go to reduce the purchase price of seeds from the growers without affecting their net income and their interest in seed production. To increase the efficiency of production, the company or organization purchasing the seed from growers should provide effective technical guidance and timely supply of seeds and share the attendant risks relating to seed production so that the farmer who grows the seed can be satisfied with a price which will provide an adequate margin between the purchase and sale prices of seeds. If these conditions are stabilized, the growing seed market and competition will ensure real quality of seeds and their availability at reasonable prices.

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9.23. A special aspect of encouragement of private seed industry is to take measures needed for stimulating growers' organizations and co-operatives. Looking to the development of seed industry in foreign countries it can be clearly seen that there is scope for large, medium sized as well as small firms in this field and quite a few of these organizations of different sizes will be co-operatives and/or other types of private organizations. The Government as a matter of fact, should continue to encourage the cooperative organizations in the field of seed production. It is gratifying to note that the National Co-operative Development Corporation has already drawn up a model scheme for the development of seed production and marketing and this facility has been utilized in some States and a few Co-operatives have already been set up. We are glad to note that in certain States growers' organizations have been formed for the production and marketing of seeds. There is considerable scope for development of such enterprises and the Team recommends that the Government should pay special attention to the development of these growers' organizations and co-operatives.

9.24. The Team recommends that the Government should take appropriate measures for the development of seed enterprises working on commercial principles in competition to ensure the supply of high-quality seeds to the farmers at reasonable prices. To achieve this objective we recommend the following measures for stimulating the growth of a healthy and vigorous seed industry:

(1) To reach the high goals set for the future a massive expansion of seed producing and distributing units is called for. Government should, therefore, through a policy declaration earmarking a major role, encourage the development of co-operative and private seed, processing, marketing and distribution organizations. As these organizations develop the departmental agencies now engaged in the production, purchase and sale of seeds should reduce their activities in this direction;

(2) The departmental agencies should provide the general planning of the various programmes including fixation of targets and concentrate on extension functions;

(3) Purchase prices to growers and sale prices to farmers should be left ordinarily to be regulated by market forces. Co-operatives and Government Undertakings as well as Departments distributing seeds should so fix their prices as to cover all their costs, overheads, risks and writes-off and provide a reasonable rate of return to the Exchequer. This is possible, as by using high quality seed the farmer is able to get adequate returns. No subsidies or guarantees would be necessary in these circumstances;

(4) The promotion of medium-sized seed growers' production and marketing co-operatives should be actively encouraged in the initial stages through liberal financial assistance by the National Cooperative Development Corporation to cover adequately the investment and working capital requirements for setting up seed production and processing units; and

(5) It is gratifying to note that the budget for 1968-69 provides tax concessions on expenditure incurred by firms using agricultural produce as raw materials in assisting farmers to grow better crops. Suitable tax concessions should also be provided to seed organizations on the expenditure incurred by them in sales promotion of seeds by provision of technical services. Such concessions should be available for an initial period of 5 years as this would encourage seed companies to undertake promotional work in rural areas.

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CHAPTER—10

SEEDS ACT AND QUALITY CONTROL

10.1. Most of the agriculturally advanced countries have legislation governing quality of seed sold to farmers. In India until recently, there was no such legislation with the exception of Jammu and Kashmir and that too in respect of vegetables only. It appears that the enactment of legislation governing the quality of seed sold follows a certain stage of development in agriculture. So long as agriculture is traditional and static and farmers use seeds of existing varieties, there is hardly a sound basis for any major trade in seeds. The farmers, in these circumstances, would prefer to use seed harvested from their own crop. They can at least be sure in such cases of the variety which they are growing and also take special care to see that the seeds are properly selected, dried, and kept in storage for good germination. The self-interest of the farmers is a sufficient safegurd in such cases to ensure that the seed is healthy and capable of giving a good stand of the crop. But with the systematic application of sicence to agriculture and the evolution of new varities capable of giving high yields or having other desirable properties, the farmers often will need to procure seed from outside agencies. With this technological change in agriculture the basis of a seed trade gets established. It has been the experience of the agriculturally advanced countries that when this happens there is need to provide basic information about the quality of seed and assure that they are not made to run undue risks in their seed purchases. Successful farming is essential for the balanced growth of the economy and it is not only in the farmers' interest but in the general interest of the public that the farmers should sow adapted varieties with good viability which are free from diseases, weeds and other mixtures. It is not, of course, the intention to circumscribe, or limit the farmer's discretion and right of choosing the variety or seed which he wants to grow. The objective rather is to provide him with adequate information in order to enable him to judge for himself. It is also part of the objective of seed legislation to ensure that the farmers are not cheated in any manner and the farmers do get the variety and the quality of the seed which they desire to buy. Generally, therefore, seed legislation in the U.S.A. and the U.K. is what may be termed a "truthful labelling law", i.e., the law requires that seed should be sold with containers clearly declaring the name of the kind and variety of seed, its purity, germination, other crop seed, weed seed and inert matter percentages. No minimum standards are laid down as this is left to the farmer and trader to decide between themselves, except in the case of small packets which do not carry the detailed labelling. For instance, a farmer may be prepared to buy seed with low germination at low cost, and use higher seed rate to make up for the poor germination. So long as the dealer declares the percentage of germination, it is considered that there is no need to restrict the freedom of the farmer to buy seeds of low germination.

10.2. The position in Europe and Japan is somewhat different. In Sweeden and the Netherlands, no seed can be sold to farmers unless it conforms to certain minimum standards and in certain kinds of crops is certified by Government agencies as such. In Japan also such a situation obtains in respect of seeds of main crops like paddy, barely etc. but in respect of vegetables the position is similar to that obtaining in the U.S.A., namely, it is sufficient to truthfully label the seed and no minimum limits are prescribed, nor is certification insisted on.

10.3. In India, the Seeds Act was passed in 1966. Like the law in the United States the Indian Seeds Act is essentially a truthful labelling law. It empowers the Government of India in consultation with the State Governmnts to notify any variety or kind of seed for specified areas. Once a kind or variety is notified, all dealers of seeds in that kind or variety are required to sell the seed in containers which have to be labelled in the prescribed manner. The contents of the label have not been spelt out in the law but would be decided by a Central Seed Committee which would be set up under the Act for advising the Central Government in the enforcement of the Seeds Act. It is obvious that the labels will contain more or less the same information as are required in foreign countries, namely, the name or kind of the variety, germination percentage, percentages of purity, weed seeds etc. In addition the Seeds Act includes a provision for mimimum germination and purity limits to be set. This could be applied to seeds in packets as well as seeds in larger containers. It is understood that the rules have been framed under the Seeds Act and these are being placed before the Parliament.

10.4. Besides truthful labelling the Seed Act also has a provision for setting up certification agencies. Certification of seed crop is a well-known method of ensuring that, the variety is true-to-type. Under the Indian Act, certification is voluntary and not compulsory i.e., those dealers who want to have their seed certified by the official agency, can get this done and others who do not want to have their seeds certified but prefer to sell their seed only under their brand names can have the option and freedom to do so. Because of the voluntary nature of the seed certification programme, the implementation of this aspect of the Seeds Act is as important as the implementation of the truth ful labelling provisions of the Seeds Act.

10.5. The Seeds Act is a major development in the history of Indian agriculture and its proper implementation will go a long way in ensuring agricultural progress. The Team, therefore, criticallly examined the various aspects of the Seeds Act particularly with regard to its enforcement under Indian conditions and the practical difficulties that are likely to be encountered in its implementation. In this respect, the Team ascertained the views of various agencies, scientists, farmers and seed dealers and would like to point out certain salient aspects that are to be kept in view, in the course of enforcement of the Seeds Act.

Enforcement of the Seeds Act :

10.6. Both at the time the Seeds Act was passed by the Parliament and in the discussions held by the Team, with various individuals, concern was voiced that the Seeds Act should not become a source of harassment to existing trade and to new trade that may be developing. At the same time there was an equal concern that the Act should not become a dead letter. It was recognized that the proper enforcement of the Seeds Act would not only be in the interest of the farmers but also in the interest of the seed trade. It is the objective of the Seeds Act to give protection to the honest seed merchants against unscrupulous and dishonest seed merchants.

Education Essential

10.7. The implementation of the Act has necessarily to be educative in the beginning. Many of the seedsmen may not be fully aware of what all needs to be done to comply with the provisions of the Seeds Act. It is, therefore, necessary to provide adequate information and training before the penal clauses are brought into operation. Education and training must also be provided to the seed inspectors and other officials dealing with the Act. Extension staff should also be fully informed of the requirements and implications of the Act so that they may correctly guide seedsmen and cultivators. The farmers must also understand the significance of the lebel and be educated to purchase properly labelled seed. The kind of training and education needed by each group will differ, and the Central and State Governments must ensure an adequate educational programme.

The Seed Inspector

10.8. If the Act is to be enforced in the spirit in which it has been framed and if the objectives referred to above are to be achieved, it is necessary to have inspectors of high calibre and undoubted integrity. It is not necessary to have a large number of inspectors spread all over the country sampling and checking seeds wherever it is sold .The objective of the Act will be better achieved, if, to begin with, each State employs a limited number of inspectors who are well-qualified, mature and who can be relied upon to inspect various seed lots, educate the seedsmen and generally enforce the Act without hampering the trade in seeds.

10.9. There should be a Chief Seed Inspector in each State and Seed Inspectors working under his control may be located at divisional headquarters. The Chief Seed Inspector himslef should be located near the Seed Testing Laboratory as he must maintain close contact with the Seed Testing Laboratory.

10.10. The Seed inspector should devote most of his time to calling on and educating seed sellers and sampling their seeds. He also must assume the responsibility for helping to acquaint extension workers with the key provisions of the Act.

Phased Implementation

10.11. The implementation of the Seeds Act is beset with many practical problems and it is necessary to have a phased implementation to gain experience. These problems may pertain to methods of drawing samples, maintenance of records, accuracy of seed testing, and provision of fair opportunity to the seed dealer to explain his position. It is suggested that initially only the major varieties of some crops might be taken and that too only in a few districts preferably in Intensive Agricultural District Programme areas. Those kinds of varieties that have high value such as vegetables and hybrids should be included in the first instance.

10.12. The seed testing laboratories in some States have not reached the level of adequate facilities or trained staff to implement the Act. Each State must examine the position and ensure accuracy of testing as this would be an important legal responsibility.

10.13. The records to be maintained by seedsmen as well as seed processors should be drawn up in detail and all seedsmen informed of the necessity of keeping such records. Needless to say, that record-keeping should be kept to the minimum but should be adequate to verify seed tests made, seed sources and sales of any particular seed lot.

10.14. It may further be pointed out that the rules which are being framed under the Act as well as the law itself should be revised with reference to actual conditions over the course of next two or three years and if any amendment becomes necessary in the interest of proper enforcement of the Seeds Act, there should be no hesitation to amend the Act and or rules.

10.15. It was understood by the Team that the Seed Rules contemplate that the seed dealer should be responsible for the germination percentage of the seed up to a certain specified date which he must declare on the seed container. The seed dealer, of course, should take every possible care to ensure that the seed in his custody has good viability and the germination does not go below prescribed minimum standards or the standards which he declares in the label and the container. But once the seed dealer has supplied the seeds to other parties or agencies, he cannot have control on the manner in which the seeds are stored and cannot be held responsible for any deterioration which might occur. It would, therefore, seem that it is unrealistic to insist that the seed dealer must accept responsibility up to a specified period of time. It is difficult under present conditions to devise containers which can preserve the viability of seeds over a specified period of time irrespective of the conditions of transport and storage. Another notable omission in the Indian Seeds Act and the proposed Rules thereunder is the absence of a grower's declaration regarding variety. Sometimes a seed dealer has to purchase seed lot of a particular variety from certain growers though he may have had no opportunity to inspect the particular seed lot. In such cases the seed dealer cannot be certain about the variety. He must insist on such occasions on a declaration from the grower regarding the variety which he is purchasing. He can indicate the variety on the container only on the basis of such a declaration. If there is any incorrect labelling arising therefrom, the grower who had given the declaration should be held, at least in part, responsible for the statements. This, in the opinion of the Team, is a legitimate protection of the dealer without which dealers may be hesitant to purchase seeds of particular varieties and label them as such.

10.16. The Indian Seeds Act empowers the Government to lay down miniumm limits of germination and purity for seeds, if necessary. The Team recommends that the results from seed testing laboratories be carefully examined after samples have been drawn for a year or two under the Act to determine the minimum limits that are practical under Indian conditions.

10.17. One of the best enforcement methods is the publication of the results of seed testing of samples. This will help to reveal to the public the poor seedsmen while at the same time identify those who are complying with the Act and selling seed properly labelled.

Seed Certification

10.18. Seed certification is not a new concept in Indian agriculture. Even the various seed development programmes envisaged inthe Second Five Year Plan provided for field inspection of various seed crops and the sealing of the seed after harvesting. Seed certification is essentially a process of quality control in the sense that what is tested is not the final product but the checking of quality at each stage of the development of the crop to ensure that the final product is indisputably of the quality desired. For this purpose the following checks have to be exercised :—

(a) An administrative check on the origin of the propagating material for the purpose of determining trueness to variety, correct name in certification, i.e., source from which the seed is sown should be pointed out with reference to relevant documents.

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(b) *Field Inspection.*—An evaluation of the growing crop for obtaining data on trueness to vartical purity, isolation requirements to prevent cross-pollination and conditions as regards diseases, objectionable weeds and admixtures;

(c) Supervision of agricultural and commercial operations of harvesting, storage, transport and processing with a view to preserving the identity of the lots;

(d) *Sample Inspection.*—An evaluation of the external quality, a laboratory test of a representative sample drawn by the certification agency. The laboratory test which may be carried out by an authorised station aims at determining the percentage of germination, moisture, content, weed seed content, admixture and purity;

(e) *Bulk Inspection.*—An evaluation of the lot for the purpose of checking the homogeneity of the bulk as compared with the sample inspected; and

(f) *Control plot testing.*—Samples drawn both from the source seed and the final seed produced can be grown in the field along with standard samples of the variety in question. By comparison it can be determined whether the varietal purity and the health of the source seed are equal to the results based on inspection. Causes of any anomaly have to be used to check purity of varieties where such purity cannot be effectively checked in field inspections.

The extent of the above checks will depend upon many factors including the nature of the variety, the extent of cross-pollination and the conditions of cultivation, harvesting, processing etc., and not in the least on the integrity of the various persons involved in the programme, which will have to be left to the discretion of the agency certifying the seed crop.

10.19. In India though certification was envisaged in the Seed Improvement Programme of the Second Five-Year Plan only some attempts were made to inspect and sell certified seeds. Seed certification on a systematic basis as envisaged above was started for the first time by the National Seeds Corporation in 1963. The N.S.C. was established for the development of seed industry in India particularly in relation to hybrids. In hybrids, certification is of special importance to ensure that the crosses are really the products of the two, three or four parental lines or single crosses as the case may be. It is not surprising, therefore, that along with its hybrid seed programme, the N.S.C. also organized certification programmes wherever it undertook seed production of hybrids. For this purpose the Corporation has built up a trained cadre of technicians, many of whom have been trained in India and a few abroad in all aspects of seed certification.

10.20. As regards the practical problems of certification we have to draw mainly on the experience of the N.S.C. and the opinion expressed by various State Governments, seed producers, farmers and seed dealers. From our extensive discussions on seed certification, the following major problems were highlighted.

10.21. Seed certification is a specialized and responsible job. Most decisions affect someone officially. When seed is rejected for certification the seed grower is a heavy loser. If seed which is not up to the mark and standard is certified, all buyers of seed and those who market the seed will suffer. It behoves the one making the decisions to ensure that the certification requirements are definite, adequate and realistic and having laid down the requirements they have to be adhered to equitably and with firmness. At the same time, the co-operation between the seed grower, the seed dealer and the certification agency is very essential. Firmness must, therefore, be combined with a certain measure of tact and understanding and a healthful and constructive attitude. Good relations are essential for effective certification. The requirements stated above clearly indicate the need for utmost care in selecting a suitable agency for certification as in all other fields of human endeavour which will not only depend upon the calibre of the personnel who are employed by the certification agency, but in selecting suitable care must be taken to ensure that the difficulties of certification are minimized to the extent possible. The first requisite for appropriate certification agency is that it should be independent from the agency producing or selling the seed on the one hand and from the agency enforcing the Seeds Act on the other. This is based on the well-known principle that the same authority cannot be the defendant as well as the judge, nor can it be the defendant as well as the prosecutor. It is clear that the certification agency should not be directly involved with the production of either foundation seed or certified seed.

10.22. Normally the certification agency should have good public relations and should have close contacts with the scientists and research personnel on the one hand and with seed growers and farmers on the other. It is only with the co-operation of all these groups referred to above that certification agency can effectively discharge its functions and succeed as a voluntary agency.

10.23. Many possible agencies suggest themselves as suitable for the purpose of undertaking certification work. The Team specifically made enquiries from various States as well as others regarding the most appropriate agency for undertaking certification work. The various possible agencies suggested were Central and State Departments of Agriculture, State or National Seeds Corporation, agricultural universities, associations of seed growers, agricultural research institutes or a combination of any of the agencies listed above.

10.24. Some of the agricultural universities are producing foundation as well as certified seeds. The State Departments of Agriculture would similarly be producing and/or marketing foundation and certified seeds for a long time to come. The National Seeds Corporation would also be producing and marketing foundation and some certified seeds. All these agencies are, therefore, ruled out as suitable certification agencies. The certification agency in our opinion should be set up as Boards constituted in different States. These Boards should be representative of seed growers, farmers, scientists, agricultural universities and the Department of Agriculture. The Boards can be registered as non-profit making societies under the Registration of Societies Act and the Chairman of such societies could be the Secretary to the Government in the Agricultural Department of the particular State concerned, who would provide requisite status and prestige essential for the successful functioning of a certification agency. A suggested scheme for an independent seed certification agency is given in Appendix VII.

10.25. It is further suggested that the work already done by the N.S.C. in the field of seed certification should be consolidated and the gains of the past four years should not be lost in the course of any proposed reorganization. For this purpose, it would be necessary to phase out the transfer of certification in respect of hybrids from the N.S.C. to the various Boards which are remommended to be organized in different States. The N.S.C. should be required to send its personnel to the various State agencies for the above purpose. Thus the State Certification Boards will have a good staff with the assistance of the experienced and trained personnel built up by the N.S.C.. Further, certification has to be a self-supporting operation though initial grants by Government may not be ruled out. As certification is voluntary under the Indian Seeds Act, the certification agency can become finally self-supporting only to the extent to which it is able to provide a good service and become popular with the seed growers.

10.26. Further, it is suggested that the State Governments should not take up certification work in all districts or for all the crops in the initial stages. They should take up seed certification work in a phased manner in a few districts. As they gain experience, they can extend their coverage gradually and take over the entire certification work from the N.S.C.

10.27. The Team gave full consideration to the arguments put forward by certain Governments that the certification work should be a part of the work of Department of Agriculture of the State Government and not that of an independent Board. It was argued that in practice no official can be expected to be hundred per cent independent and the Directors of Agriculture etc., were high public functionaries who could be relied upon to take an objective view of any position. It was also argued that the Director of Agriculture and his staff were most concerned about the quality of seed supplied to the farmers and would, therefore, be the most appropriate agency for seed certification work.

10.28. It is certainly true that the Government servants in India at these levels have a capacity for taking objective view in any good situation. It is equally true that the Director of Agriculture is responsible to the farmers for the quality of the seeds which are supplied to them and will not, therefore, easily compromise on quality in respect of certification. At the same time, the fact remains that the Director of Agriculture will have other functions including the functions of seed production, seed law enforcement and extension work. If, in addition, he also takes up the function of seed certification, there might be naturally conflict of interests making the situation rather difficult. Further, in the opinion of the Team, the Board is likely to be subject to lesser pressures of various kinds than the Director of Agriculture or any particular official. As on the Board representatives of all the interests are involved, no particular interest is in a position to dominate it or influence the decision and everyone concerned would necessarily have the motivation to be objective and fair. Seed Certification Boards have functioned successfully in the U.S.A. and the Netherlands and there is no reason why they will not succeed in India also. Further, the constitution of independent Boards provides an opportunity for adopting expeditious procedure and methods in paper work and in arriving at speedy decisions. If the seed certification work is entrusted to another Government office the procedure etc. might become cumbersome. The Team, therefore, strongly recommends that seed certification Boards be formed in every State. The Board should work in close liaison with the Central Seed Certification Committee, which should be a sub-committee of the Central Seeds Committee envisaged under the Indian Seeds Act. The Central Seed Committee will lay down the basic standards, procedures, policies and guidelines but will have no formal authority over the Seed Certification Agencies. The Central Seed Committees would use their influence rather than give directions to the State agency. But normally speaking the State agencies would fall in line with any well-conceived policy or guideline given by the Central Seed Certification Committee. Unlike in the United States where there is wide diversity of certification agencies in the different States and some differences in certification standards, now is an opportunity of providing uniform standards and the policies in respect of the seed certification though the enforcement thereof may be left to individual States. The Central Seed Committee should in this connection adopt the same approach as the O.E.C.D. adopts in respect of the different countries in the world. A summary of the approach adopted by the O.E.C.D. has been given in Chapter 20.

10.29. It is also necessary to have a Central certification agency for the purposes of O.E.C.D. programme. This agency need not have staff of its own, but it can operate through the various State certification agencies. In our opinion, the Central Seed, Committee would be the most appropriate agency in respect of O.E.C.D. certification.

Financing of the State Boards

10.30. Whatever is the form, any certification agency must be self-supporting. Seed certification is a service offered as a result of which the seed growers and producers normally are able to get a good price for quality seed. There is no reason why the activity should be subsidized as seed growers and seed producers should be in a position to pay for the services being provided to them. In the initial stages, it may not be possible for seed certification agencies to be self-supporting and it is recommended that Government grants should be given in respect of buildings, equipment, vehicles and staff in the early stages, but with the stipulation that every certification agency should be self-supporting within a period of five years.

Staffing of certification agencies

10.31. Seed certification is a technical job and should be undertaken under the guidance of specialists. It involves many decisions of scientific nature and the seed certification agency should have with it scientists in different disciplines particularly in plant breeding and pathology. The Seed Certification Officer should be well qualified with a good knowledge of plant breeding, agronomy and public relations. It is not necessary that the field jobs should be done by persons with high scientific qualifications. It is essential that the field staff should be well trained and be able to verify and adhere to the standards laid down. Further, the certification work may be of a seasonal nature. In foreign countries many part-time employees are utilized for certification work. Many of them were reported to be doing an excellent job. The qualities required for certification work are—(i) meticulousness; (ii) ability and willingness to travel quickly and widely; (iii) integrity ; (iv) a certain measure of physical stamina; (v) maturity of judgment ; and (vi) capacity for good public relations.

Certification Standards

10.32. Laying down of precise and realistic standards for certification is very important. These standards may refer to field conditions or they may refer to the procedures in inspection of the harvested produce as well as the manner of harvesting, transporting, the processing plant, seed transport and packing it self. In this connection, the Team recommends the adoption of the system of approved processing plants. Proper processing of seed is vital for ensuring the viability of the seeds. Further, unless a certification agency keeps track of the harvested produce until it is packed and sealed, the identity of the lots cannot be assured. It is, therefore, necessary that the seed certification agency should lay down standards for processing plants and give approval to those plants which comply with the standards. Seeds which are not processed at these plants should not be certified.

10.33. Appendix VIII gives the field standards as well as the various standards for seeds currently adopted by the N.S.C. as well as those adopted by certain other foreign agencies. The standards should be reviewed once a year and changes made in order to make them realistic. It is recommended that once the standards are set for a particular year, they should not be varied arbitrarily though very exceptional circumstances might justify a departure from this principle. The drawing of samples for laboratory testing and the bulk inspection to ensure uniformity of the lot are vital steps in seed certification. The Team was informed that the function of drawing samples for seed certification was to be entrusted to seed inspectors to be appointed by the Government for enforcing the Seeds Act. The functions of the seed certification agency and of the seed inspector enforcing the Seeds Act are very different and should be kept separate. It should be the task of the seed certification agency and not the seed inspector of the Government to draw samples from lots which are being considered for certification. After seed has been properly certified and is ready for sale, it would be subject to the Seeds Act provisions just like all other seeds.

Eligibility of varieties for Certification

10.34. A question arises, if all varieties should be certified by the certification agencies or only some varieties and if so, what should be the criteria for determining eligibility of varieties for certification. Technically speaking, certification means no more than a guarantee to trueness to variety of the particular seed. It does not, in theory, carry with it any recommendation in regard to the agronomic performance of the seed being certified. But under Indian conditions a certificate given by an official agency like the Seed Certification Board will carry with it considerable prestige to the farmers who are likely to buy such seeds under the impression that these have the requisite official clearance and support. It is very necessary to ensure that the farmers are not misled in any manner and we have to keep in view that farmers are not misled if a certificate is issued for a variety which is not known for its agronomic value. In view of this paramount consideration, we feel that the concept of certification for varietal purity only, does not have relevance in our immediate context. We feel that certification should apply only to those varieties which are finally recognized as equal or superior to existing varieties. In other words, only those varieties which are finally released by the State Variety Release Committee or the Central Variety Release Committee should be taken up for certification. Further, all varieties released by the State and Central Release Committees need not be automatically accepted by the certification agencies as fit for certification. It is open to the certification agencies to examine each variety and then accept only those varieties which fulfil the requirements of eligibility for certification. We recommend the conditions enumerated by the International Crop Improvement Association of the United States for determining the eligibility of varieties for certification, as given in Appendix IX.

10.35. The question was also raised as to whether certification should not be made compulsory especially in respect of high-yielding varieties. Some of the State Governments were of the opinion that unless certification was made compulsory, farmers will not be able to obtain seed of the requisite quality especially in hybrids. The Team has given careful consideration to this point of view. If the certification agency does a good job and a good educational programme is carried out, farmers would automatically prefer certified seed to non-certified seed. The need for compelling the farmer to take only certified seed in respect of certain varieties would arise only if it is felt that the sale of non-certified seed of the same variety is likely to result in some mischief. It is felt that fears in this regard are unfounded and we can rely on the good sense of the farmer to prefer only certified seed except in cases where he is really certain that a particular brand which is not certified is still of very high quality and is equal to seed certification standards. The Team does not think that there is sufficient ground for insisting by law that the farmer must purchase only certified seed. The truthful labelling aspects of the Seeds Act will provide adequate protection as indicated earlier.

10.36. In the Seed Certification programmes of the N.S.C. considerable emphasis has been given to field inspection as well as to laboratory test. Equal emphasis has not been laid on the trial plot cultivation. We understand that the N.S.C. has established recently a Quality Control Section, one of whose primary functions and responsibilities would be to have field plot checking of all classes of seeds, i.e., breeder seed, foundation seed as well as certified seed. We recommend this step of the National Seeds Corporation to the various seed certification agencies that would be established in course of next few years. We suggest that suitable plots should be taken and placed under the control of the seed certification agencies, where they can grow samples from different lots of foundation seeds and certified seeds against standard samples maintained by them in order to check the effectiveness of field inspection and to evaluate the quality of the seed being produced both in the foundation and certified seed classes. Similarly Seed Act enforcement agencies will also require facilities for testing the correctness of varietal labelling.

Sealing and Packing

10.37. All the steps taken for ensuring the quality of the certified seed is of value only to the extent to which the seeds are properly tagged and sealed. Any scope for mischief or malpractices at the stage of tagging and sealing will defeat the very objective of certification. The Team was informed that the N.S.C. was using lead seals so far; though they had experimented on tin seals sometimes they did not find them satisfactory. It was informed that the tin seals are generally attractive and also more effective than lead seals. We suggest that further work should be done for improving the present sealing arrangements though we were informed that the present sealing system serves the purpose and is quite satisfactory.

10.38. As regards tags, it was brought to the notice of the Team that sometimes old tags which are left over with seed growers, producers etc. are being misused by being attached to uncertified seed lots. It is also possible, at present, for an unscrupulous seed dealer to draw tags similar in appearance to seed certification tags and attach them to any lot of seeds he desires. In order to prevent such occurrences, it is recommended that the certification trade mark should be registered under the Trade Marks Act so that if any mal practices are discovered, suitable legal proceedings could be instituted. Further, certification agency must keep a close control on the stocks of tags lying with them. The tags should be normally machine numbered and handled in the same manner as cash receipt books.

SEED TESTING

Background

10.39. The testing of seeds for germination and purity has been recognized as an essential aspect of good quality seed programmes in many countries through the years. Without a means to accurately evaluate the germination and purity of seeds, it is impossible to carry forward with a comprehensive seed certification programme or a seed law enforcement effort. The need for good seed testing laboratories in India was recognized in the late fifties and steps were taken to establish one laboratory per State. Today, India has seventeen main seed testing stations. In addition, six branch laboratories have been established by the States. The number of samples tested has grown from 6,000 in 1962 to 65,000 in 1967. This growth has been closely associated with the increased production of certified hybrid seeds of maize, sorghum and bajra.

10.40. Training programmes were conducted concurrently at the Indian Agricultural Research Institute, as seed testing laboratories were being established. A booklet on "How to draw seed samples and submit them to a laboratory" was prepared. A "Seed Testing Manual" which summarized material from various world-wide references and adapted it for India was printed and is in use.

Needs of Today and the Future

10.41. Good progress has been made in this programme. However, as the seed certification programme expands and the Seeds Act is implemented, considerable strengthening of the facilities and the quality of work being done will be needed. The Team, therefore, recommends that immediate steps be taken to assure that the seed testing programme does keep pace and properly supports the seed industry and the seed improvement programme.

10.42. Specifically the following points need emphasis :

(1) The achievement of uniform results from one laboratory to another and within the same laboratory appears very difficult. The variability of the results which are currently being observed appears to be due to the lack of :

(a) adequate facilities ;

(b) understanding of the prescribed rules and uniform application of the rules ;

(c) training and experience on the part of the staff ;

(d) experience in evaluating normal and abnormal seedlings as well as fresh, ungerminated and dead seeds.

(2) To help eliminate the variability that does exist, the main additional facilities needed in most laboratories are cooling systems to be used with the existing germinators and walk-in room germinators which are temperature contolled at the prescribed temperatures. Such walk-in room germinators can greatly increase the capacity of the laboratories and assure that proper temperature control is maintained on all the samples being tested for germination. These walk-in room germiantors can be used in conjunction with existing cabinet germinators.

(3) Training programmes must be continued to assure that all workers in the laboratory have been trained.

(4) All-India workshops where workers from the laboratories can come together to compare experience and results have been useful and should be continued.

(5) Referee testing where parts of the same sample are sent to different laboratories for testing can help to detect weaknesses and variability and assist the laboratories in improving their standard of performance. Referee tests should be carried out systematically by the Central Seed Testing Laboratory.

(6) Methods of germination for new species need to be investigated at the different seed laboratories in coordination with the Central Seed Testing Laboratory.

(7) The quality of the indigenous paper for germination still varies considerably. This, undoubtedly, affects the test results. We understand that the Forest Research Institute, Dehra Dun, has considered this problem and taken some steps towards a solution. We would recommend that this be treated with the highest priority and that the Institute also supply the needed paper through its pilot plant until commercial production is feasible. The import of this special paper should not be necessary.

(8) The nature of this work is such that a high degree of uniformity in not only testing methods, but also recording and reporting procedures is extremely desirable and necessary. Therefore, testing procedures, reports, registers and working cards should be standardized throughout the country. Yearly reports should be issued and collected by the Central Seed Testing Laboratory. Such information will be of great value to the Central Seed Committee.

(9) More adequate space to assure safe storage of seed for at least 12 months, is needed in most of the laboratories. Airconditioning and/or dehumidifying will be needed in most locations. This will become increasingly important with the implementation of the Seeds Act in which case reference may need to be made to samples previously tested.

(10) Many of the research problems related to seed testing procedures and methods are similar for the entire country. For this reason, we strongly recommend that the Central Seed Testing Laboratory be encouraged and staffed, so that it can provide adequate coordination and leadership to the laboratories throughout the country. To achieve this and to help the state laboatories overcome difficulties, it is important that the most experienced members of the Central Seed Testing Laboratory staff be in a position to travel extensively, as needed to provide guidance on the spot. Such staff members could assist in conducting short workshops within individual laboratories on special problems they are facing.

(11) Seed Testing Officers should maintain closer liasion with plant pathologists and entomologists to assure that these specialists are kept fully informed on problems confronting the seed industry as observed in the laboratories. Similarly, the concerned specialists may contribute useful suggestions regarding the laboratories, role in controlling specific disease or insect problems.

Number of Laboratories

10.43. Because of the problems which currently exist in the variability of the results between the few existing laboratories and the need for improving their staff and facility, the Team strongly recommends that only one official seed testing laboratory be developed per state, fully equipped and staffed with well-trained personnel. The need to increase the number of laboratories will not arise for a number of years to come. Capacities of seed testing laboratories around the world vary from those able to test 15,000 samples to those testing 100,000 samples per year. Therefore the existing laboratories can be strengthened to meet the needs of the States including testing for the seed certification and the Seeds Act enforcement programmes. As the number of samples to be tested increase far above present levels we may review the need for more laboratories. However, lack of experienced personnel and equipment necessitates the concentration on one good laboratory currently. The concentration of the testing facilities at one location can greatly facilitate the speed and quality of work done.

Indigenous Equipment available

10.44. The National Seeds Corporation has recently established a seed testing laboratory by the use of completely indigenous equipment. We feel that existing laboratories can add to their equipment and build their programmes without the need for the import of equipment for this purpose. Similarly, seed organizations having a desire to establish a small testing facility for their own use should be encouraged and can also utilize locally made balances and other specialized equipment.

Maintaining Trained Staff

10.45. One of the most serious difficulties in the programme currently, is the maintenance of a well qualified and trained staff. To become technically competent, a seed analyst needs at least one to two years' experience. The Seed Testing Officer must be more than just an administrator, and be thoroughly familiar with all aspects of seed testing and seed quality control. Of the 128 persons trained during the last six years, only 45 are in the laboratories. This points out emphatically that trained personnel are being diverted to other areas to the detriment of seed work which is undesirable and should be prevented. Existing laboratories have 48 technicians who have not been trained in the Central programme. The staffing patterns within the laboratories and the opportunities for advancement within the work place serious limitations on the programme. The Chief Seed Analysts and Seed Testing Officers in other countries often have from 15—25 years of experience.

10.46 It is strongly recommended that if a good worker in a laboratory gets a turn for promotion in his present cadre, he be given the benefit by upgrading his post, so that his training and experience are available to the laboratory and the seed programme.

10.47 The proposed Division of Seed Technology could contribute immeasurably to the training needs as well as research needs under the programme. As indicated elsewhere, we see a strong need for the formation of this Division.

Activities of Laboratories

10.48 (1) The Seed Testing Officer and key workers in the laboratory must recognize that they have a responsibility to the seed industry as well as the total seed improvement programme in the country. They should maintain a good working relationship with farmers, extension workers, the seed trade, the scientists and administrators. Their work cannot be limited to the walls of their laboratory.

(3) As there is further development of the seed certification programme and the Seeds Act enforcement programme, the need for field plot tests to check varietal purity will greatly increase. This needs to be recognized as an integral part of the total programme and could probably be best arranged by the seed testing laboratories.

(3) To assure timely testing of samples, the laboratories need greater flexibility in terms of their ability to hire casual help such as students and unemployed individuals during peak seasons. One laboratory has made arrangements for this. Delays cannot be tolerated in reporting results of samples because of the urgency inherent in the programme. Therefore, such a provision must be available to all Seed Testing Officers. Samples should be put for germination within 24 hours from the time of receipt.

Relating the Laboratories to Seed Certification and Seeds Act Enforcement

10.49 (1) Very close daily contacts will be needed between the Seed Testing Officer, the Seed Certification Officer and Chief Seed Inspector under the Seeds Act and they should be so located that this is made possible.

(2) Another aspect that needs continuous close working relationship is the fixing of minimum seed certification standards and minimum limits under the Seeds Act. The Central Seed Committee

has the responsibility to help achieve uniformity across the country. However, the Central Seed Committee should only make these decisions with facts about present conditions. Therefore, the following are recommended :—

(a) Minimum seed certification standards and limits should be realistic and relate to present seed quality;

(b) The results obtained in seed testing should be statistically analysed and tabulated by every State each year and sent to the Central Seed Testing Officer for compilation and should be made available to the Central Seed Committee;

(c) Seed surveys based on seed used by farmers should be undertaken to verify the practical level of minimum seed germination limits and for educational purposes; and

(d) The statistical accuracy of the amount tested must be considered when fixing standards for purity components. Ordinary seed testing methods must be able to measure the standard with accuracy.

(3) In some States, the laboratories are still bound administratively to some particular section of the Department of Agriculture instead of being more directly responsible to the Director of Agriculture. This arrangement often seems to make it difficult for the laboratory to properly service all kinds of crops. We recommend that a more direct and clear cut line of communication be developed between the Director of Agriculture and the Laboratory. A single laboratory can meet the needs of crops even including forest tree seeds.

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An Independent State Seed Certification Agency and its relationship to other Agencies

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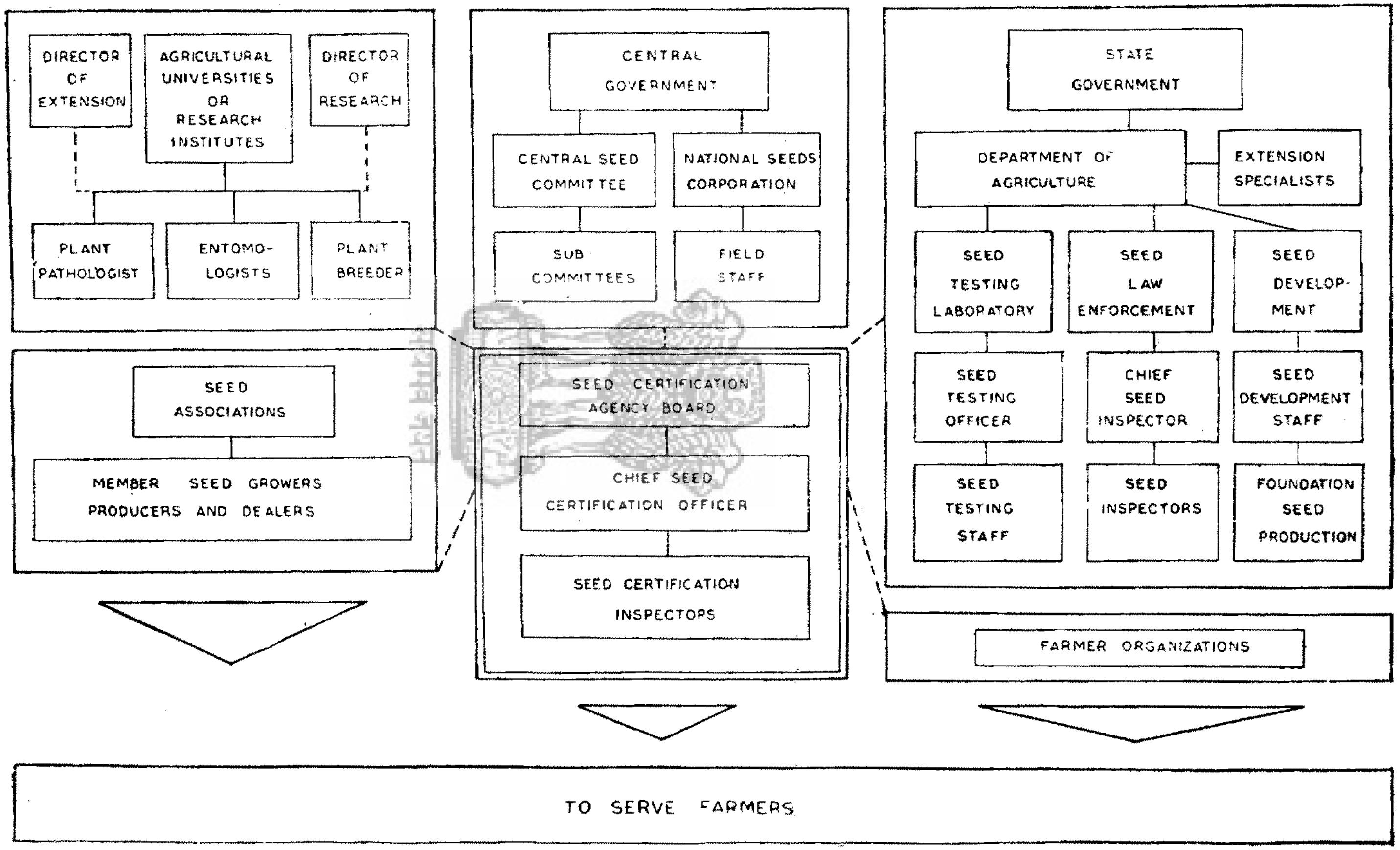
AN INDEPENDENT STATE SEED CERTIFICATION AGENCY AND ITS RELATIONSHIP TO OTHER AGENCIES



CHAPTR 11

TRAINING

Present Position

11.1. The need for properly trained and well qualified persons is an essential part of any seed improvement programme. Since the first Seed Testing Training Course was offered in 1961, 23 courses of various kinds have been provided to train people in not only seed testing, but also seed production, processing, seed certification and seed development. A coursewise summary of the numbers and kinds of programmes offered during this period is as follows :—

COURSEWISE SUMMARY OF THE PROGRAMMES

(1961—1968 May)

Serial No.	Number of series held	Kind of group		Total No of Trainees
1	12	Seed Production, Processing and Certification	..	327
2	7	Seed Testing	..	128
3	2	Vegetable Seed improvement	..	35
4	2	Seed Development Officers Course	..	25
		Grand Total	..	515

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11.2 During the same period, approximately 15 persons have been sent from the States and the National Seeds Corporation for special training in various aspects of the seed improvement in foreign countries. Most of these programmes have been for six to twelve months depending upon the nature of training to be provided.

Training Activities in Foreign Countries

11.3. Countries with more advanced seed programmes continue to carry out training programmes at various levels for certain kinds of personnel. However, it must be recognized that their programmes have been developing over a period of time and many experienced personnel exist. Therefore, less need exists for the high intensity of continuous traininng which is needed to meet our immediate needs.

11.4. For example, the National Institute of Botany at Cambridge, England, conducts special training courses for seed analysts largely working in private seed testing laboratories over the country. Similarly, three or four key seed testing laboratories in the U.S.A. offer annual courses in seed analysis to interested persons.

11.5. Many countries have special associations for seed control officials, seed certification personnel and seed analysts. These associations meet at least annually, and carry with their meetings a strong emphasis on education and refresher training.

11.6. The Mississippi State University through its Seed Technology Laboratory offers special one week short courses to seedsmen in the U.S.A as well as programmes for foreign personnel. Both graduate and post-graduate degree programmes is seed technology are available at Mississippi. Most other universities in the U.S.A. include Seed Technology in Agronomy and Plant Breeding courses, but do not offer degrees in this discipline.

11.7. Seed certification agencies and seed law enforcement organizations often either separately or in co-operation with agricultural universities provide special field days and conferences for seedsmen both at state and regional levels.

11.8. Associations of seedsmen also sponsor special conferences and educational programmes at national, regional and state levels to help members of the seed industry keep abreast with the changing times. These programmes are usually sponsored on an annual basis. They sometimes are carried out cropwise such as the Annual Hybrid Corn Conference sponsored by the American Seed Trade Association. At a meeting of this kind, some of the leading plant breeders and seed technologists from universities and segments of the private industry present papers and information which are of interest to the seed industry.

Future Needs for Training in India

11.9. (a) *Kinds of persons to be trained*—When considering the needs for training, it is important to consider first the kinds of individuals who must be trained. These include the following:-

(i) Administrators, especially Deputy Directors for seeds or persons with similar responsibilities,

(ii) Agricultural universities' lecturers and trainers in the extension programme;

(iii) Seed certification officers and seed certification inspectors;

(iv) Chief seed inspectors and seed inspectors under the Seeds Act enforcement programmes;

(v) Seed testing officers and seed analysts;

(vi) Seed development officers and other agricultural extension workers involved in Seed educational and demonstration work;

(vii) Central and state seed farm managers;

(viii) Seed growers, producers and dealers;

(ix) Seed processing plant managers, mechanics; and

(x) Seed marketing personnel.

11.10. (b) *Responsibility for Training.*—It must be recognized that both the Central and State Governments have special responsibility for training. In order to achieve the ultimate objective to assure an adequate number of well trained personnel and to avoid unnecessary duplication, it is highly desirable that both the Central and State Governments define the areas of training for which they are going to assume responsibility. The Team would recommend the following divisions of responsibility:-

(a) *Central Responsibility*—The Centre should assume responsibility for training in those areas where uniform procedures and techniques are needed throughout the country and where a relatively small number of a highly trained and competent persons are needed. The programmes would range from one week to seven weeks depending upon the kind of training needed. These would include:

(i) *Seed Testing Officers and Seed Analysts.*—Although 128 persons have been trained in seed testing during the past seven years, only 45 of these personnel are reported to be currently working in the laboratories. The seventeen main seed testing laboratories throughout the country currently have 48 untrained personnel. Assuming a continued expansion of the seed testing programme, similar to that which has occurred during the past three to four years, it seems clear that 25 to 40 new persons per year need to be trained.

(ii) *Seed Inspectors for the Seeds Act.*—The implementation of the Seeds Act will require training of many groups of people. The Chief Seed Inspector and Seed Inspectors who are actively involved in the work should be trained at the Centre. To date, no special training has been provided to persons in this category, although three or four people have received some special training overseas for a month or two. The number of inspectors to be trained will be related to how rapidly a State notifies different kinds and varieties to be brought under the Seeds Act and the kind of job classification that is provided for the Seed Inspectors. We recommend that the Seed Inspectors be trained for seed law enforcement work with no other secondary responsibilities. Assuming that a State moves ahead with reasonable speed in notifying kinds and varieties and that the Seed Inspectors can concentrate on only this task, we estimate that 5-10 Inspectors would be needed per State by the end of the next five years. Although every effort should be made to promote the Seed Inspectors in such a way that they could be kept on the job, it is recognized that not all persons trained will stay on this job indefinitely. We, therefore, feel that provision should be made for training 200—250 Inspectors during the next five years.

(iii) *Seed certification officers and inspectors.*—Seed certification is a highly specialised activity and hence both the Seed Certification Officers and Seed Certification Inspectors need proper training. The National Seeds Corporation's staff, consisting of over 360 management and inspecting personnel, represents the largest single corps of persons with special training in this field. Although all of these persons have had experience in seed certification, only one half have actually undergone one of the six to seven weeks intensive training course.

As the states undertake the formation of seed certification agencies, it is extremely important that the building up of a trained Staff at the state level be done systematically and carefully . The National Seeds Corporation is in a position to provide service to the States by deputing selected key staff members to the new certification agencies as they are formed.

Assuming that one inspector can cover from 500 to 1,000 acres of certified seed production per year, if he is mobile, the number of inspectors needed by each agency can be determined based on acreage estimates. A large number of persons will be needed throughout the country in the seed certification programme during the next five years. In addition to the assistance from the National Seeds Corporation in training the seed certification staff in the field, special training courses should continue to be organized for providing systematic training to the seed certification officers and seed inspectors.

(iv) *Unviersitr Lecturers and Extension trainers.*—University lecturers and extension training instructors will need special short courses and work-shops to acquaint them with the latest developments in the seed improvement programme and to provide them with the best information available prior to their training of other personnel.

(v) Administrative personnel with Departments of Agriculture from all the States should continue to meet periodically in workshops and through special tours and conferences have at least a portion of their time devoted to keeping up with the latest developments in the seed programme.

(vi) Selected agricultural engineers and processing plant managers from the States and private organizations need training.

(vii) Seed production and seed development personnel with the National Seeds Corporation, State Governments and private programmes should receive training from the Centre on a selective basis.

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(viii) Seed marketing personnel.

(b) *State Responsibility.*—The training of personnel at the state level in most cases would be of shorter duration ranging from one week to three weeks. Nevertheless, the number of people to be trained at the State level would be much larger. It should not be necessary for the Centre to provide a specialist for every training programme offered at the State level. The effectiveness of the central training should be measured in part by how well personnel in the seed testing laboratories, the seed certifying agencies, the seed law enforcement programme , the National Seeds Corporation and the agricultural universities are able to organize a systematic programme for training personnel within their States. The main groups upon which attention should be focussed at the State level include:

(i) Seed development officers and agricultural extension workers specially concerned with the seed improvement programme and demonstrations.
(ii) Seed growers, seed producers, seed dealers and seed farm managers.
(iii) Seed processing plant managers, mechanics and agricultural engineers not included in the central programme. The centrally trained men must train others in the States.

In addition to official programmes organized through the Departments of Agriculture and the universities, the seed producers' associations should be encouraged to assume greater leadership in training and educating their members. Personnel from the universities and the departments should always stand ready to assist and support special programmes of this nature offered by the seed associations.

Facilities for Training

11.11. The existing training programmes at the Centre have been carried out by the National Seeds Corporation and the Indian Agricultural Research Institute co-operating with various other Indian and foreign agencies working in India. It is recognized that this is a temporary phase and a "stop gap" measure to meet the urgent needs of to day. As we look towards the immediate and long-term future, it is essential that a more permanent kind of training facility and staff be developed to assume the major responsibility for executing programmes for which the Centre needs to assume the leading role.

11.12. It has been proposed that the Indian Agricultural Research Institute establish a Seed Technology Division which would be in a position to assume this major responsibility. It must be recognized that the National Seeds Corporation which is actively involved in the production and certification of seeds today must continue to assist to assure that training programmes be as meaningful as possible. The training programmes with a special emphasis on seed law enforcement and seed testing could be organized by the Division in co-operation with the Ministry, since the Seeds Act and the Central Seed Committee, whose Secretary would be in the Ministry, would have special responsibilities for implementing these aspects of the programme.

11.13. In addition to this short-term training effort, a vital need exists for graduate and post-graduate work in the general area of Seed Technology. The Seed Technology Division, in co-operation with other divisions at the I.A.R.I., would be in an excellent position to offer a post-graduate degree programme and help meet the needs of the future for persons especially equipped to assume leadership and responsibility in seed improvement.

11.14. The agricultural universities can assume a leading role also in the training of persons in seed improvement by :—

(a) inclusion of material on seed production and Seed Technology in existing Agronomy and Botany courses ;

(b) Organizing, in co-operation with others, seed production and processing courses of short duration for persons needing training at the State level as referred to earlier ; and

(c) Offering degree courses in various aspects of Seed Technology.

11.15 It may not be difficult for many agricultural universities to arrange for instruction in seed production and technology as part of their existing agronomy courses after acquainting the professors and lecturers with the latest developments in this field through the special training courses mentioned earlier.

11.16. A few universities which have special facilities for seed production at their disposal and perhaps access to a seed testing laboratory can easily undertake the short courses mentioned. These universities ultimately could develop degree courses covering seed production, seed processing, plant design and engineering, seed testing, certification, quality control and seed pathology. These few universities with special advantages would need to cater to the need of the entire country because this discipline is not one that would need to be pursued by every university. The U.P. Agricultural University has made a start in this direction and is offering one selective course in seed production and technology. The I.A.R.I. offers a post-graduate course in seed technology. These represent a good start. However, the rapid expansion of the programme will of necessity mean a rapid upgrading of these beginnings.

11.17. Students trained under such programmes will have many opportunities for being absorbed by the Agricultural Departments in their seed testing and seed law enforcement programmes, by seed certifying agencies, on the department's seed farms and seed development and extension programmes, by the National Seeds Corporation and in the very rapidly growing private seed industry.

Personnel and Material for Training

11.18. Training should not be undertaken without recognizing that a concerted effort must be made and that the best of the personnel in the programme must be used. Training should not mean a series of lectures, but should provide the maximum amount of "learning by doing" opportunity for the trainees. Developing this kind of training is much more difficult and expensive than having a few people deliver lectures. Emphasis at the State and Centre must be both on quality of personnel involved and the quality of training offered. To achieve this, the organizations involved in training must utilize to the maximum actual equipment and fields for laboratory experiences. In addition, publications, flannelgraphs, slides, movies and charts need to be developed. A limited number are currently being used in the programme offered at the centre. Since this is a very specialized field and the material needed is not required in large quantities, special attention must be given to the limited duplication of material available.

Opportunities for Foreign Training

11.19. Progress in seed improvement has been considerable in many foreign countries during the last 30—40 years. Many of the techniques used are similar in many countries. Their procedures could be adopted easily to our conditions. The International Seed Testing Association, the International Crop Improvement Association, the Mississippi State University Seed Technology Laboratory, many seed testing laboratories in Europe, the U.K. and the U.S.A., seed firms and seed co-operatives offer numerous opportunities for training. Many of these organizations have had long experience and are keenly interested in assisting wherever possible.

11.20. It will be very helpful if the National Seeds Corporation and selected Central and State personnel are provided with an opportunity for training in other countries. The Team, therefore, recommends that a systematic plan for training in other countries be developed so that the best qualified and most interested persons in seed testing, seed production, seed processing and seed marketing be given an opportunity for this training. In most cases, such training need not be for a degree, although in a few cases, especially in the case of professors in agricultural universities and persons working in the Division of Seed Technology, I.A.R.I., a degree programme would be useful.

11.21. Although existing programmes have provided some opportunities for training of this nature to officials, we feel that much can be gained if non-officials in the seed industry can also be given similar experiences. The number of seed organizations need to be increased and their programmes expanded. This can best be achieved by having a top management that knows where it is going and how to achieve its objectives. Strong seed associations are need to properly represent the seed industry and to develop good communication and educational efforts within the industry. Experiences by Indian seedsmen in more developed programmes can help to build this leadership more quickly.

11.22. Special emphasis should be placed on the development of organizations and seed associations. From a more technical stand point actual experience in seed processing and seed marketing would be most helpful. It is recommended that the India Crop Improvement and Certified Seed Producers' Association and the All India Seed Growers, Merchants and Nurserymen's Association develop a programme in co-operation with the Government for a systematic training of their associations' leaders who would be in a position to share their experiences and knowledge with members of the respective associations.

11.23. The U.S.A.I.D., New Delhi, has a programme for training candidates from the fertilizer industry in the public and private sectors in the field of production, marketing management and general administration. Our recommendation would involve the development of a similar programme in co-operation with the U.S.A.I.D., the Rockefeller Foundation and other organizations co-operating with the government in the seed improvement Programme. This programme should include training and study tours for seed growers interested in seed processing and marketing,

Utilization of Trained Personnel

11.24. The proper use of personnel trained in seed testing, referred to earlier, is but one example of a continuous problem. It will be impossible to train the number of people needed in the seed improvement programme unless ways are found to continue to properly utilize their training over a period of time. Even personnel trained overseas too often return to find that the six months or one year's training is of little significance in the new unrelated jobs that they have been given upon return.

11.25. We can no longer afford to have training efforts not fully utilized. Men trained as pilots do not become locomotive engineers. Neither should we expect Seed Testing Officers to become Soil Conservation Specialists.

11.26. Greater care needs to be exercised in selecting the person to be trained. The chances of his being shifted soon or being promoted out of the present job should be foreseen and only those that can be on the work for a period of time should be trained. As a minimum it should be expected that if shifting from one job to another may occur to a degree, at least the shifts should be confined to the broad framework of the seed programme. For example, a seed analyst might move into seed law enforcement work or vice versa. Even these changes will require some new orientation and training of the worker.

11.27. Seed Technology is a relatively new discipline in India. Arrangements for promotion and advancement do not have to follow old patterns. The range of technical skill needed is great enough that all grades can be utilized in the overall staffing pattern of seed testing laboratories, and seed production units. Provisions should be made for promotions in the line in turn based upon experience and capability in the particular seed speciality undertaken.

CHAPTER-12

ROLE OF VARIOUS AGENCIES

12.1. There are now a large number of agencies—government as well as private—interested in the seed development programme. These agencies are mainly :—

(a) The Government of India (Department of Agriculture).

(b) The State Governments (Departments of Agriculture).

(c) The Indian Council of Agricultural Research.

(d) The Indian Agricultural Research Institute.

(e) The National Seeds Corporation.

(f) The State and Central Agricultural Research Institutes.

(g) The Agricultural Universities.

(h) The National and State level Co-operative Marketing Federations.

(i) The Co-operative Marketing Societies at village block and district levels.

(j) Seed Companies and Corporations.

(k) Progressive farmers and their associations.

(l) Joint Stock Companies and partnership firms interested in agriculture and particularly handling fertilizers, insecticides etc.

(m) Central and State Government farms.

(n) Seed Growers' and Dealers' Associations.

12.2. The multiplicity of agencies dealing in such a vital aspect of agriculture is certainly to be welcome. In the nature of things it would be difficult in this activity to lay down rigidly the precise tasks of each agency and to enforce them. But to avoid overlapping of activities and consequent waste of efforts, it is necessary to broadly demarcate the roles of the different agencies in seed development work and adhere to them as far as possible. Each of the agencies listed above has certain advantages as well as certain limitations for handling certain aspects of seed improvement programmes. Keeping these in view, their resources must be utilized in the most effective manner.

Role of the Central Government (Department of Agriculture)

12.3. Though agriculture is essentially a State subject under our Constitution, research, laying down of standards, inter-State commerce and commerce with foreign countries are within the purview of the Central Government. Further, as the Central Government assumes the overall responsibility for ensuring an adequate growth in the economy, the Department of Agriculture of the Central Government plays a vital role in guiding and co-ordinating the activities of the State Governments. The very process of planning at national level makes this inevitable. In so far as seeds are concerned, planning on a national scale is very important as thereby the progress of seed improvement in the different States can be expedited. The Central Government must also ensure uniform standards and procedures in enforcement of the Seeds Act and in seed certification. It must maintain sufficient research and seed testing facilities on a national scale. It must keep in touch with the requirements of the State Governments, and assist them both in regard to seed supply to meet urgent requirements and in hastening of the adoption of new technologies in seeds. It should be the national authority for the registration of varieties and assure that a national index of varieties is maintained as discussed in previous chapters. Further, it must continue to provide financial assistance to States to develop their seed programmes in accordance with national policies and make periodic evaluation of the progress achieved in each State. It must also assume responsibility for providing foreign exchange required for essential imports of equipment and know-how.

Indian Council of Agricultural Research

12.4. The I.C.A.R. is the premier organization in the country guiding, co-ordinating and promoting agricultural research. It has under its control leading research institutes like the Indian Agricultural Research Institute, the Rice Research Institute, etc. As the highest technical body in the field of agriculture it has a special role to play in seed improvement programme. It must pay special attention to the introduction of new varieties, to the strengthening of research in plant breeding and allied subjects and to the promotion of research amongst private agencies. It should strengthen the co-ordinated research programmes in various crops by assuring adequate funds. It should also be responsible for registration of private research organizations. It must organize storage facilities for genetic stocks as described by us in Chapter 18, para 18.18 and make breeding material available to the public as well as private research agencies. It must streamline release procedures for varieties and advise States accordingly. It must strengthen seed technology work in the various research institutes under its control and in aided institutions.

12.5. An important function of the I.C.A.R. should be the publication of type books, illustrating the more important varieties and their characteristics.

12 6. The I.C.A.R. has a special responsibility in respect of breeder seed production. It must lay down standard procedures for breeder seed production of each crop. It must also allocate clear cut responsibility to different research stations for the maintenance of breeder stock of particular varieties.

The Indian Agricultural Research Institute

12.7. As the premier research institute in the country, the responsibilities of the I.A.R.I. are very wide and include the development of basic techniques and procedures in plant breeding. We are here concerned with specific responsibility in the field of seed development. These should include studies on the maintenance of viability and vigour in seeds under different conditions, and the most appropriate methods of storage, harvesting, processing, etc. for the improvement of seeds. It must pay special attention to standardizing techniques of seed testing including the techniques of testing varieties by field control. We have recommended the formation of a Seed Technology Division at I.A.R.I. It will need to undertake much research and educational work of immediate importance to the seed industry.

12.8. The Seed Testing Laboratory at the I.A.R.I. is affiliated to the International Seed Testing Association. One of the basic problems in seed testing is the variability in the results of seeds tested in different laboratories. The International Seed Testing Association has been attempting to make seed testing procedures more uniform and to train seed testing personnel in the procedures and methods. Unless seed testing can give uniform and consistent results the value of seed testing is considerably reduced. The I.S.T.A. has a system of referee testing to bring about uniformity. Besides it holds a number of seminars and discussions to analyse variances. There are 17 main seed testing laboratories in India, and the Indian Agricultural Research Institute has a major task of playing the same role towards these laboratories as the I.S.T.A. has been providing to the laboratories in member countries. This is a major responsibility as without proper seed testing there can be no effective enforcement of the Seeds Act and development of the seed certification programmes.

12.9. Another important function of the I.A.R.I. is the organization of training courses. The training of seed growers and personnel at block and district levels in the States should be the responsibility of the State Governments. The training in seed production, processing and marketing as well as certification has been the responsibility of the National Seeds Corporation in co-operation with the I.A.R.I. and should continue until the Seed Technology Division at I.A.R.I. is well established. Even at this point the N.S.C. should continue to assist in this aspect of training. But in the field of seed testing and in the specialized aspects of seed improvement the I.A.R.I. must continue to organize training programmes for at least the State level trainees. Further all the employees of the seed testing laboratories in different States must be trained by I.A.R.I. for some years to come. The I.A.R.I. must pay special attention to research in seed pathology and to investigations on the vigour of seeds both of which are assuming greater importance than before.

The National Seeds Corporation

12.10. The N.S.C. established in July, 1963 to promote a seed enterprise in India and in particular to serve as a foundation seed supply agency for hybrids has played a useful role. It has promoted the establishment of a number of seed enterprises by farmers, co-operatives as well as by business organizations. It has provided technical guidance and equipment to these agencies and to State Governments. It has organised certification services in almost all the States. It is understood that currently it has over 7,000 farmers on contract with it. It has established its own farms for foundation seed production and 25 processing plants to meet its requirements and to provide custom processing. It has assisted the State Governments, private organizations and farmers to set up processing plants. It has also helped in the development of the manufacture of seed processing equipment and built up cold storage facilities for foundation seeds. It has served as a reserve source of supply for certified seeds enabling the State Governments to fulfil the targets of agricultural production programmes. It has acted as a promoter of new varieties by supplying seeds on a larger scale in respect of new outstanding varieties.

12.11. With the enforcement of the Seeds Act, the N.S.C. would be giving up its function as seed certification agency. Under the Seeds Act, the State Governments have to set up certification agencies. The N.S.C. must assist the State Governments in setting up such agencies and make an orderly transfer of work. The main advantages enjoyed by the N.S.C. stem from its character as an all-India organization capable of utilizing the various agro-climatic conditions in the country and the facilities in the State and Central Government Farms and with progressive farmers at short notice. Besides, the N.S.C. has built up a considerable organization and expertise in the field of seeds. These should be utilized to give a major impetus in the Fourth Five-Year Plan to the entire seed improvement programme. The N.S.C. in particular should function:

(a) as a major source of foundation seed supply not only in respect of hybrids but in respect of selected varieties of all-India importance ;

(b) as an agency for arranging pre-release multiplication of all varieties evolved under the all-India co-ordinated schemes and any other outstanding variety;

(c) as an agency for rapid increase of foundation seed in the early stages of a new variety by utilizing different agro-climatic conditions in the country;

(d) as a supplier of foundation seeds to private seed producers and to State governments, encouraging the private seed producers to market seeds on their own;

(e) as a source of technical information and guidance in all matters of seed production, processing and marketing with a view to developing a sound seed enterprise; and

(f) as an agency for providing training in seed production, processing and certification.

12.12. In addition to the above functions, which are partly of a promotional character, the NSC should continue to have certain commercial operations with a view to initiating and encouraging quality seed production activity in the field of vegetables fodder seeds and seeds of commercial crops. In order to effectively assist in the seed improvement programmes, the NSC must help the seed industry develop modern marketing methods. The export of seeds to foreign countries should receive special attention of the Corporation as it can help the growing seed industry to a large extent. We also envisage a special role for the NSC in the field of seed processing. Many seed producers and State Governments require assistance in drawing a plan for seed processing. Each processing plant must be designed to meet the specific requirements of crops and quantities to be handled and take into account the local climatic conditions, the availability of labour and equipment. At present, the NSC is furnishing standardized blue-prints. We recommend that the NSC must go beyond this and furnish an advisory service. They can indicate the source of supply of quality machines and can even arrange to procure and supply such machines. In certain cases, they can put up a processing plant on a turn-key basis. They can cover the costs of such consultancy services by charging suitable fees or charging the margin on the equipment sold. In doing this, they should not be inhibited by any consideration that their recommendations may subject them to the criticism of favouring one or other of the manufacturing firms etc. We have stated this with a view to remove a handicap which can be real to any cell charged with such responsibility of a delicate nature.

12.13. The non-availability of reliable seed processing equipment has been a major difficulty in seed development work. We have already recommended elsewhere the need for a design-cum-engineering organisation which should assist the manufacturing firms by the provision of proto-types, designs, testing and advisory services and by placement of orders. The NSC has already done a certain amount of work in this direction. We recommend that the NSC should accept this responsibility fully and develop suitable organization for this purpose.

State Governments

12.14. The State Governments have the major responsibility of drawing up seed improvement programmes within the State and ensuring the achievement of the various plan targets. In addition, they have to enforce the Seeds Act, 1966 and set up independent seed certification agencies. Detailed recommendations in regard to these have been made by us in the relevant chapters. The State Governments must also strengthen research on plant breeding and the seed testing laboratories at the State level. They should design and implement policies that would enable growth of the seed enterprise in the private and co-operative sector. Still, however, the procurement and distribution of seeds by private agencies and co-operatives would not be adequate to achieve the targets under the plan. The State Governments must be prepared to step in, procure the seeds and distribute the same through the extension agencies. Such activities should, however, be temporary. Seed supply functions should be separated from the extension agencies as early as possible.

12.15. It is in the field of extension work that the State Governments and the Directorates of Agriculture must play the most important role. Farmers require considerable extension work before they would take to new varieties. Many of the new varieties require cultural practices that are quite different from what the farmers are quite used to in respect of local varieties. The benefits of an improved seed programme cannot be achieved without effective extension work. Where the extension work is taken up by the agricultural universities they should pay special attention to this aspect.

Agricultural Universities

12.16. The agricultural universities are in a better position to contribute significantly to improved seed programme on account of the technical experts in different disciplines who are readily available with them. Research is a major function of agricultural universities in most States. The progress of seed improvement in India will be closely linked to the progress of research in plant breeding, and the universities have an important responsibility in this direction. Where the universities have adequate land under their control they can take up breeder seed multiplication, pre-release multiplication and foundation seed production on behalf of the agencies entrusted with these functions. They should also be in a position to provide training programmes at the State level in respect of seeds. They can offer specialized courses in Seed Technology leading to a degree. They need to participate effectively in the State certification agency's programmes.

Co-operatives

12.17. The co-operatives are in a special position to make a significant contribution in certified seeds. We have already referred to the need to relieve the State Governments' extension agencies of supply functions. This can be achieved rapidly if the co-operatives move into the seed trade fast enough. The co-operatives have an advantage of a network of retail depots, and have also the requisite financial resources. In the past, the seed distribution work was not considered sufficiently attractive and subsidies and guarantees were sought from the government. This trend has now changed and the pr curement and distribution of seeds is now considered a commercial operation. The co-operatives can develop a sound and profitable business in the distribution of seeds by adopting modern marketing methods. They should find it to their advantage to work with private seed organizations that are producing and processing seeds.

12.18. In the field of seed production and processing it may be possible to establish specialized seed production societies. A few such societies have already been established in Andhra Pradesh and Maharashtra. As a large number of such production units would be needed in the years to come, the National Co-operative Development Corporation which has already circulated a model scheme in this connection may pay special attention for the development of such societies. They should also expand their activities to processing and marketing.

Private Sector

12.19. The private sector has a large scope and opportunity for developing modern seed companies as the procurement, processing and distribution of seeds has become a commercially viable operation. We have observed how in the advanced countries, private seed enterprise has played a key-role in the provision of seeds to farmers and contributed significantly to agricultural development. Such seed companies come to have their own research departments as their resources are built up. The seed industry in India is not reserved for the public sector. It is typically a small or medium sized industry which can be effectively organized by enterprising individuals or joint stock companies. The role of various seed companies and farmers' associations have already been discussed in the Chapter on Seed Marketing in detail. It would be sufficient to point out here that if private seed enterprise should develop in India it will be on the basis of marketing of seeds direct to farmers through commercial channels. If private seed companies depend on government purchases unduly, they will be no more than growers of seeds. Private seed companies and seed growers must, therefore, give special attention to the development of marketing work. They should no doubt, get the necessary incentives and encouragement for rapid growth.

Seed Growers' Associations

12.20. There are at present two major associations of seed producers and seed dealers. They are the India Crop Improvement and Certified Seed Producers' Association and the All-India Vegetable Seed Growers, Merchants and Nurserymen's Association. These organizations have important functions to discharge in the development of seed industry. The prestige which seedsmen enjoy amongst the public will depend on the conscientious performance of their duties. These organizations must impose certain measure of internal discipline amongst seedsmen and seed dealers and develop standards of conduct and performance that would make the penal provisions of Seeds Act superfluous. They must also serve as a forum for the discussions of various problems of seed enterprise and serve as an agency for representing the problems of seed industry to the Government and other public agencies. They should provide common services to all seedsmen by providing them valuable information on new varieties, processes, export possibilities and general market information.

12.21. Suggested role and activities of seed growers' associations are :—

(a) assist in the development of independent seed certification agencies and continue support and leadership to the seed certification programme;

(b) provide support to the implementation of the Seeds Act and propose improvements to be considered by Government for improving the rules under the Act;

(c) prepare and publish reports and other educational, statistical and promotional material that will be useful to the members of seed industry and farmers;

(d) assist in formulating the State and national seed policies and to co-operate with the Government and other concerned agencies in furtherance of common objectives;

(e) sponsor special field days and conferences that will be useful to its members, the seed industry and farmers; and

(f) sponsor special research projects in seed technology or special breeding projects not being undertaken by regular government programmes.

12.22. The roles and functions of various agencies cannot be defined in a static manner. As conditions change, new agencies will come into the picture and the roles of existing agencies will undergo change. To a large extent the role of each agency will depend on the effectiveness of its performance and its usefulness to the community. At the same time, it must be recognized that if everything changed all the time, there can be no planning and no orderly development. The Governments at the State as well as the Central levels must lay down clear-cut policies defining the roles of different agencies and such a policy should be reasonably firm and be operative for a reasonable period to evaluate the results and reap the benefits.

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CHAPTER—13

PROVISION OF FINANCE AND CREDIT

13.1. Long-term and short-term finance and credit required for seed production, distribution and marketing, fall into three categories, which could be identified as under :—

(a) financial needs of seed growers ;

(b) financial needs of seed processors and marketing firms ; and

(c) financial needs of farmers for purchase of seeds.

Financial needs of seed growers

13.2. Most farm lands used for growing seeds need to be properly developed. The normal tendency is to sow seed crop on the best land available, avoiding areas that are not properly levelled or waterlogged. To achieve the levels of output necessary to make a success of the agricultural programmes, it is essential to bring more areas for seed growing, which necessarily involves investment in land improvement works and development of irrigation facilities. The cost of land improvement can be quite substantial and this fact needs to be fully recognized, when considering the measures for financing and provision of credit. While the cost of land improvement and development of irrigational facilities constitutes a major part of the long-term needs of seed growers, the requirements for acquisition of necessary farm machinery for ploughing, harrowing, tilling, preparation of seed beds, ridging, planting, spraying, threshing, harvesting, vehicles, drying and stores cannot be ignored. After a careful examination of the costs of various items it is estimated that the average requirement for development may work out to Rs. 5,000 per acre.

13.3. While the above constitutes the long and medium-term finance needs, the grower needs short-term finance to meet the cost of inputs—foundation seeds, fertilizers, pesticides, labour and operational costs. A fair estimate of these costs on an average could be taken at Rs. 800 to Rs. 1,000 per acre, depending upon the crop.

13.4. According to the present thinking and the targets under consideration for achievement during the Fourth Plan period, the total area that would need to be brought under seed production for hybrids and high-yielding varieties of major crops—maize, jowar, bajra, wheat and paddy—alone, is of the order of 3.6 lakhs acres as shown below:—

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Serial No.	Crop		1973-74 targets (million acres)	Annual seed requirement (tonnes) **	Area required for seed production (acres)**
1	Paddy	..	25	62,000	31,000
2	Wheat	..	15	1,20,000	80,000
3	Maize	..	5	32,000	54,000
4	Jowar	..	8	32,000	1,28,000
5	Bajra	..	7	10,000	70,000
	Total	..	60	2,56,000	3,63,000

**The estimates of seed requirements given above are based on the rates currently in use and seed yields being obtained at present. There is scope for reducing seed rates in respect of many crops. The extension agency can play a useful and educative role in this regard. As the seed rates are reduced the seed requirements will be reduced and as seed yields go up, the acreage needed for seed production will also go down. With the spread of composites in maize, the renewal period of seed will be less frequent and reduce annual seed production requirements. On the other hand, the present estimates pertain only to the High-Yielding Varieties Programme areas and seed would be required for other areas also. In the circumstances, the estimates must be considered as indicating the order of magnitude of credit needs than as a precise estimate of requirements.

Hybrids and high-yielding varieties cover only a part of the cropped area and it is necessary to bring under cultivation a further 2.4 lakh acres to meet the needs of the remaining areas, thus making a total of 6 lakh acres under seed production. However, with assured irrigation facilities for seed farms, it should be possible to resort to double cropping. The actual area to be developed could well be halved in many areas and taken at 4 lakh acres. On the basis of the above estimates, seed growers' requirements of long-term and medium-term finance would work out to a total of Rs. 200 crores over the next 3 to 5 years.

13.5. With the accent on agricultural development in the last few years and the enthusiasm shown by the farmers, the tempo of development is likely to be further intensified in the near future and there will be a certain amount of generation of cash, a good portion of which is bound to be re-invested on agricultural farms. While it is difficult to estimate precisely the proportion that the farmers will invest from their own resources, it could on an average be taken that approximately 50 per cent of the requirements would be met from farmers' own resources. There is also the point that not all the land that will be brought under seed production will need this large amount of finance per acre for development, as large areas are already developed and assured of irrigation facilities and may need investment only for land shaping and other purposes. Assuming that approximately 50 per cent of area to be brought under seed production are likely to have assured irrigation facilities, it is estimated that in respect of this area the requirements of finance will be reduced by about Rs. 1,000 per acre. Taking into account all these factors, the long-term and medium-term finance required for development of land and provision of irrigation facilities over the next three to five years would be of the order of 90 crores.

The basis on which this estimate has been worked out is shown below :

		Acres
Total acreage under seed production	..	6,00,000
Reduction on account of double cropping	..	2,00,000
Net area under seed production	..	4,00,000
		(Rs in crores)
Cost of development at Rs. 5,000 per acre for 50 per cent of the area and at Rs. 4,000 per acre for balance 50 per cent	..	150
Assuming 50 per cent of this would be met by farmers, balance to be financed by institutions	..	90

13.6. Short-term finance requirements to cover the cost of inputs and farm operations including labour is reckoned at about Rs. 30 crores, taking an average of Rs. 750 per acre for 4 lakhs acres. A part of this credit, however, is likely to be met by the seed companies and so the actual requirements of the growers to be provided by the financial institutions could be reckoned at much less than this figure. Even allowing for this, on the basis of the above figures, the finance requirements of the seed growers alone could well be of the order of 100 crores at the end of five years, as will be noted from the following statement:

		Area to be developed for seed production	Finance required Rs.
1969-70	..	1.6 lakh acres	40.0 crores
1970-71	..	0.6 „ „	15.0 „
1971-72	..	0.5 „ „	12.5 „
1972-73	..	0.6 „ „	15.0 „
1973-74	..	0.7 „ „	17.5 „
Total	..	4.0 lakh acres	100.00 crores

Financial needs of seed processors and marketing firms

13.7. The financial requirements of seed processors and marketing firms can be classified under two major heads :—

(i) Long and medium-term finance needed for investment in fixed assets such as farm machinery, processing machinery, buildings, warehouses and transport vehicles.

(ii) Short-term finance requirements to cover operational costs, finance needed to assist the growers, for purchase of the produce from the growers, holding of stocks, promotional, marketing and distribution costs including credit to dealers and farmers.

13.8. The total volume of seeds to be processed and distributed to meet the requirements of the areas that will be brought under cultivation of the major crops is estimated at 4,00,000 tonnes. The capital investment for plant and machinery, buildings and warehouses is estimated at Rs. 750 per ton for an economic size of processing unit. On this basis the fixed investment required for this purpose is Rs. 30 crores. It could reasonably be expected that at least a third of this amount would be met by entrepreneurs themselves by raising their own capital. So the requirements of long-term finance to be provided by financial institutions and banks over the next three to four years could be estimated at Rs. 20 crores.

13.9. Short-term finance or working capital requirements for the processing and merchandising of the above volume of seeds can be estimated as under :—

(i) Operational and packaging costs at Rs. 350 per ton of processed seeds (About Rs. 14 crores for 400,000 tonnes).

(ii) Finance to cover assistance to growers for purchase of foundation seeds, inputs like fertilizers and pesticides and as advance for cultivation, purchase of raw seeds, holding of stocks, distribution and marketing—Rs. 60 crores.

Working capital requirements could, therefore, be estimated at about Rs. 7.5 crores. It is to be noted that the ratio of working capital requirements to the investment cost of processing facilities is 3 : 1 and this is high when compared with other industries, where the working capital requirements are normally very much lower than the investment in fixed assets and ranges from 25 to 50 per cent of such investment. This is mainly due to the fact that sale of seeds is restricted to the planting season and stocks have to be built up in the preceding season and held over a long period. Besides, credit needs of seed growers as well as distributors have to be met by the producers.

Financial needs of farmers

13.10. The farmers' needs for growing commercial grains should cover not only seeds, but also fertilizers, pesticides and other farm operations. The investment that is required for seeds is comparatively small, but nevertheless, it is essential that the agricultural credit set up is considerably strengthened to provide this, as the requirements on this account will aggregate to Rs. 100 crores in the next three to five years. As various other Committees have recommended measures for provding the credit needs of farmers for purchase of agricultural inputs, it is not proposed to discuss this aspect in detail in this Report but we would like, due note of this fact to be taken.

13.11. In regard to the long-term credit needed for land development and provision of irrigation facilities, institutions like Land Development Banks do provide some credit, but this is inadequate to meet the requirements. So far as short-term credit required by the seed growers is concerned, besides the normal sources available to them such as Co-operative Credit Societies and commercial banks, the seed processing and distributing organizations should also be in a position to provide credit for foundation seeds, inputs like fertilizers and pesticides and seed certification fees and this is why their working capital requirements are higher. However, commercial banks as well as seed companies are handicapped in providing sufficient volume of credit, as they cannot be adequately secured.

13.12. In the recent past, an encouraging trend has been noticed in that the commercial Banks have shown a willingness to extend credit to seed growers, but they are purely guided by the credit-worthiness of the individuals or firms concerned. We feel that the commercial Banks should be encouraged to extend an increased volume of credit to cover both the long-term and short-term requirements of finance and this objective can be achieved if a Government backed corporation could guarantee or underwrite the risks involved. The Fertilizer Credit Committee of the Fertilizer Association of India headed by Shri Venkatappiah has recommended the formation of a Fertilizer Credit Guarantee Corporation and set out in detail the aims and objectives of this Corporation as in Appendix X. We recommend that as seeds are vital agricultural inputs, they should also be covered by this scheme along with fertilizers and pesticides.

13.13. Even more difficult problems arise in the case of credit requirements of organizations which process and market seeds. An estimate of the credit requirements of seed firms has been given earlier. These organizations need funds to provide finance to growers for purchase of inputs such as seeds, fertilizers and pesticides and payment of seed certification fees and to cover part of the cost of the farm operations. Again, at harvest time they need finance to purchase the produce of growers, to process the stocks and to store until they are sold to farmers several months later for commercial grain cultivation. A large volume of funds is, therefore, needed to ensure that the operations are carried out uninterrupted.

13.14. Generally, firms have experienced difficulties in hypothecating processed seeds, as advances against these are made only on a restrictive basis on the strength of certificates issued by the National Seeds Corporation or production against Government contracts. On raw seeds, no advances are made. In certain areas, it was represented that the Banks reckon the value of seeds for purpose of advances only at grain prices. We have highlighted in para 13.9 the fact that the working capital requirements of seed companies are relatively high in relation to the fixed capital requirements. In view of these difficulties, these organizations are unable to find adequate finance and are obliged to meet the working capital requirements out of long-term loans and share capital which are scarce.

13.15. The requirements of finance over the next three to five years, as indicated above, are only Rs. 75 crores and it should not be difficult for the various financial institutions and commercial Banks, some of whom are already financing the seed producers, to meet their requirements. The main difficulty, however, lies in devising a suitable system for providing loans safeguarding fully the interests of the lender, as the borrowers are not in a position to offer adequate security. The commercial Banks are also experiencing difficulty in advancing against the raw seeds due to restrictions placed by the Reserve Bank on advances against foodgrains. We recommend that the Reserve Bank should make it clear to commercial Banks that all seed, raw or processed, certified or non-certified, whether produced on contract with State Governments or National Seeds Corporation or not, should be treated as agricultural input and not as grain for purposes of advance. We also recommend that steps be taken to guarantee advances made to seed producers and that this be included in the scope of activities of the Fertilizer Credit Gaurantee Corporation proposed by the Venkatappiah Committee.

13.16. As regards the long-term finance requirements of the seed companies, it has earlier been estimated at Rs. 20 crores. We feel that the existing financial institutions such as the Industrial Development Bank of India, Industrial Credit and Investment Corporation of India, Industrial Finance Corporation of India and State Financial Corporations should be in a position to provide this small amount of finance more so as the seed industry has now been declared as a priority industry. In this context it is worth pointing out that properly constructed and insulated warehouses, where humidity and temperature can be precisely controlled, are essential for storage of seeds. In the case of seed potatoes, cold storage is necessary. There exists some confusion in the minds of financial institutions to advance money for construction of warehouses and cold storages. In view of the importance of the provision of special type warehouses for this industry, we recommend that steps should be taken by the financial institutions to provide necessary advances for construction of such warehouses and treat them as advances made to seed industry so that all benefits available to the priority industry can be claimed.

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PART III

सत्यमेव जयते

CHAPTER—14

THE NETHERLANDS

14.1. The Netherlands with a population of 12 million have the following important crops :—

(a) Winter sown cereals	.. Winter wheat, winter barley, winter rye
(b) Spring sown cereals	.. Spring wheat, spring barley, spring rye, oats and barley mixed
(c) Pulses	.. Peas, broad beans, vetches, field beans
(d) Oilseeds	.. Rape and mustard
(e) Fibre plants	.. Flax
(f) Root crops	.. Potatoes and beetroots
(g) Forage crops	.. Different kinds of grasses and legumes
(h) Vegetables	
(i) Ornamental plants	

14.2. The seed industry in the Netherlands is particularly specialized in herbage, horticultural and ornamental plants. Since the end of the 19th Century there has been a growing interest in high quality seeds and seed potatoes. The farmers were no longer content with seed lots having a good appearance but wished to have a prior inspection of the seed crops. The breeding of new varieties assumed great importance. As a result of the enterprise of the farmers, merchants, scientists and the Government, the Netherlands have been able to build up a flourishing industry with large exports to foreign buyers.

ARRANGEMENTS FOR RESEARCH

14.3. The research by public institutions is mostly in the field of fundamental research and techniques. This is only a recent change. Originally public institutions used to do applied research also. The two most important institutions in this field are (1) the Institute of Plant Breeding (IVP) and (2) Foundation for Agricultural Plant Breeding (SVP). Both these institutions are located in Wageningen. The Institute of Plant Breeding was founded in 1912 and is now a department of the State Agricultural University. The Foundation for Agricultural Plant Breeding was started in 1948. Its objectives are to develop plant breeding methods, evolve new varieties rendering services to plant breeders and supply breeding material for further exploitation. The development of new varieties, at present, is in the hands of private agencies. Private firms employ plant breeders for this purpose. The development of private efforts in this field has undoubtedly been fostered by the flourishing seed trade in the country and the existence of a law conferring patent rights to the breeders as early as 1941. This law known as Breeders' Decree of 1941 has been recently amended in June, 1967, in order to take account of the regulation of the Paris Convention for the Protection of Breeders' Rights and the direction of the European Economic Community in this regard. Under this law, the plant breeder has in principle exclusive rights to produce breeding material of varieties developed by him, to bring it to the market, to trade it, to export it, to keep it in storage for these purposes, or to have these actions performed by others. These rights last for 20 years (25 years for potatoes). The breeder has the corresponding responsibility to make adequate seeds available in respect of varieties evolved by him, at reasonable prices. If he fails to do so, or is adamant on the prices the Government might intervene and grant permission to others to arrange for multiplication of the variety. There is a Council of Breeders' Rights which regulates the conditions of the rights and responsibilities of the breeders.

TESTING, INDEXING, TRIALS AND RELEASE OF VARIETIES

14.4. All new varieties have to be indexed in a central register of varieties. No trade in any variety is permissible unless it is included in this general list. The basic reason for this centres around the breeders' rights provisions. The testing of the varieties for inclusion in this list is confined to establishing that the variety is distinct and new from existing varieties and is sufficiently homogeneous and constant so that it maintains its characteristics during multiplication cycle.

14.5. With several cross-pollinating varieties, however, it is difficult to describe different varieties sufficiently clearly and they are also less homogeneous. These varieties are also included in the variety register under the name of the breeder. Though no breeders' rights are given in respect of such varieties, the breeders do enjoy a practical monopoly. The approval of these varieties for inclusion in the register is the function of a Government committee consisting of two members nominated by the Minister and the Director of the Institute for Research on Varieties of Field Crops (IVRO).

14.6. The IVRO undertakes morphological and other studies to find out the characteristics of a new selection and to establish whether it is a new variety or not. It also conducts field trials to assess the agricultural values of the varieties. These trials are spread out all over the country. Based on these trials, a descriptive list of the variety is prepared. Until the recent amendment of 1967, trade was permitted only if the variety was included in the descriptive list. This meant that a variety had to be officially released after testing for genetic distinctness as well as economic superiority before it could be traded in. After the amendment of 1967 the position has changed. The descriptive list is now only of advisory value. Once a variety is considered distinct and new and is included in the register of varieties, its trading is permitted. It may, however, be added that considerable importance is attached to the descriptive list of varieties and before additions are made to this list, farmers' opinions are collected and the results of trials conducted with the help of extension agencies, etc., are taken into account.

PRODUCTION OF BREEDER SEED

14.7. It is the specific responsibility of the breeder himself to maintain and produce sufficient quantities of pure seed for further multiplication. If he cannot do it himself he has to permit some agency to undertake such a responsibility.

FURTHER MULTIPLICATION

14.8. The seed industry in the Netherlands, as already pointed out, is mostly specializing in herbage, horticulture and ornamental plant seeds. There are five large firms operating in the Netherlands, three of which sell forage seeds and two are engaged in the production of forage as well as vegetable, and cereal seeds. These firms have large modern processing plants. The plant of Barenbrugs Zaadhandel N.V. at Arnheim is typical of a herbage seed processing plant and was visited by the Team. The plant had special equipment for separating weed seeds with cylindrical and other specially designed separators and graders. A special feature introduced in the plant was the drying of forage seeds in bags in special chambers. These chambers have false floors with ovalshaped hatches about 2 feet long on which the bags are laid. Heated air is blown from the bottom for drying. The temperature is controlled the rmostatically. Empty bags are cleaned with pneumatic equipment to ensure freedom from mixture from other seeds. Though the plant had good storage facilities, due to good harvest, there was more seed than the available space and the surplus was stored in the open on pallets and completely covered by polythene.

14.9. A noteworthy feature of this firm was that they grow herbage stock seeds in large quantities to last for 5 to 10 years. These are stored under controlled conditions of temperature and humidity. Changes in varietal characteristics from year to year are thus avoided.

14.10. The firms enter into contract with farmers for production of seeds. In addition to such production, they may organize on their own farms. There are two types of contracts. In one type, the contract to be paid to the farmers is fixed in advance at the time of entering into the contract. This includes a premium over the average crop price. In the second type, there is sharing of net realizations made by the company. The farmer generally receives 80 per cent of the net wholesale price. The quantity for which the payment is made is based on the results of the analysis of the seed lots as furnished by the Central Seed Testing Laboratory at Wageningen. The firms normally take delivery of the farmers, production at the farm sites though some contracts provide for delivery at the processing plants.

14.11. In addition to the larger firms, there are a number of small firms and individual farmers who produce and sell forage and vegetable seeds. Many of these have their own processing units, though some have their seed processed through other plants by paying processing fees.

QUALITY CONTROL

14.12. The work of seed certification has been entrusted to The Netherlands General Inspection Service for the field crops and seed potatoes (N.A.K). According to the law, anyone who engages in cultivation, processing or sealing of seeds and planting material, must become a member of the N.A.K. It is also forbidden to trade in any material that has not been inspected, certified and sealed or any material which has deteriorated due to prolonged storage. The N.A.K. is a foundation subject to Government supervision. The objectives of the N.A.K. are : —

(a) To promote by means of certification that only reliable quality seeds are brought into commerce, trade and export.

(b) To stimulate the production and use of reliable quality seeds, and its further improvement.

(c) To implement the official regulations relating to certification.

14.13. The Board of the N.A.K. is composed of certification specialists, breeders, growers of seeds and planting material, processors, traders and users.

14.14. This Board co-operates fully with the Government to make the supervision effective. The officials in charge of the enforcement of the Seed Act attend the meetings of the Board as well as the Executive Committee of N.A.K. and receive all information relating to the working of this organization.

14.15. The N.A.K. is a self-supporting organization and is not subsidized by the Government. The revenues are obtained from the tariffs that have been laid down for field inspection and for sealing of certified lots of seed and planting material. The maximum charges are subject to Government's approval. The inspection functions are decentralized and taken care of by 12 regional organizations, each with its own Boards similar to that of the central N.A.K. While the regional agency is responsible for the performance of its staff in its own allotted area, the central agency issues necessary instructions, for inspection and supervision of the work of regional agency. For the execution of these functions N.A.K. has over 350 members on their staff.

14.16. The certification work falls under two categories :

(a) inspection and certification in the fields, (b) inspection of harvested materials. The field inspection is primarily to verify the trueness to variety, to observe any diseases that may be transmitted with the seed and to see whether any admixtures of weeds occur which may be difficult or impossible to remove from the harvested produce. For different crops, minimum requirements are laid down and these may differ for different classes of seeds. If a crop meets minimum requirements it will be approved. If it does not comply with these requirements, the field will be rejected, and the seed to be harvested will not be allowed to be traded as seeds. During inspection of harvested produce, the certifying agency supervises the transport of the produce from the farms to the processing plant, or the seed houses so as to preserve the identity of the lots. In the case of fodder crops, samples are often taken of the uncleaned seed lots of the farm. As the percentage of pure seeds obtained from such samples constitutes the basis of payment to the growers, this is not part of certification work but a service rendered to seedsmen and farmers.

14.17. Cleaning of lots is followed by a lot inspection, by which homogeneity is judged. Only uniform lots are accepted for certification. Sampling is done in accordance with the International Seed Testing Association's Rules. When the results of lot inspection and analysis of the samples prove that the lot meets the standards, the seeds are certified. There is close co-operation with the Government laboratory to guarantee that uniform procedures are followed by different certifying agencies.

14.18. To evaluate the quality of the certified seeds in the field a larger number of samples are sown in field trials. This may be deemed as post-control. In the case of seed potatoes, this is done on experimental plots of the regional certifying agencies and in the case of agricultural seeds and exported lots, it is done in the central farm of the N.A.K. The post-control trials are intended to verify whether the approved seed lots are up to the standard. The post-control of foundation seeds is also used as a pre-control for the next generation. The certifying agency co-operates with a number of other institutions such as the Institute for Research on Variety of Field Crops, the Plant Protection Service, the Plant Pathology Laboratory of the Agriculture University, and similar institutions. There are also several advisory committees consisting of experts and representatives of the trade to advise the N.A.K. on the problems of the different crops.

HORTICULTURAL CROPS

14.19. The system of certification and control of vegetable and flower seeds is different from that of agricultural crops and seed potatoes. The reason which led to the establishment of separate agencies for vegetables and flower seeds are : (a) The great diversity of crops and varieties needed by market gardeners, private gardeners and the processing industry; (b) The spread of the commercial seed production over different regions outside the Netherlands; and (c) Great numbers of small units in which seed is sold to ultimate users. Experience had shown that controls are exclusively based on field inspection, as it would be necessary to adopt procedures suited to the nature of the crops and the structure of the various sections engaged in their production and trade. In view of these considerations, separate inspection services for vegetable and flower seeds, for nursery crops and for ornamental crops have been established.

14.20. Vegetable and flower seeds come under the General Netherlands Inspection Service for Vegetables and Flowers Seeds (N.A.K.G.). This service has been functioning for over 25 years and presently the Seed Law of 1967 defines the standards of inspection service and the regulations N.A.K.G. must comply with in order to be appointed by the Ministry of Agriculture to be entrusted with the work of certification. In accordance with this, the constitution of N.A.K.G. defines its objective as to promote the production of and trading of reliable seeds of vegetable and flower crops. This main objective is achieved by (a) setting standards for reproductive material and the lots derived therefrom in regard to trueness to variety, varietal, purity, health, germinating capacity and other important qualities. (b) inspection of crops (c) laying down standards for technical equipment, technical management and administration of seed firms and (d) controlling the observance of these regulations.

14.21. In the performance of its inspection service, the N.A.K.G. is subject to Government supervision. All the decisions of the N.A.K.G. Board, whether administrative or technical, are subject to the Minister's approval. N.A.K.G. is a foundation and the members of the Board are representatives of all relevant sectors of production and trade. Technical experts are co-opted to the Board. The Executive functions are perfomed by a Director whose appointment has to be approved by the Minister.

14.22. The N.A.K.G's inspection activities are primarily aimed at the inspection of the basic material. viz., the basic seed (Foundation Seed). Firms that are regularly and efficiently engaged in producing basic seeds are enrolled as 'selection firms'. They are accepted as such for a specific crop or crops and a careful administrative check is kept on the varieties of the crops on the production of which they are engaged. When a firm is regularly and purposefully engaged in breeding work to produce new varieties, it is accepted as a 'breeder firm'. Normally selection firms may only multiply and produce commercial seed of varieties selected by themselves and approved by the N.A.K.G. Basic seed can be purchased from other selection firms.

14.23. Inspection of the basic seed is performed by —

(a) regular inspection of selection firms to check their selection and breeding methods and the results obtained. This is an important aspect of the inspection of basic seed and that of the preceding generations;

(b) field inspection of all fields (or in the case of biennial crops, inspecting the fully developed material); where basic seed production takes place 2,000—3,000 fields are inspected every year;

(c) field testing in the trial plots of the N.A.K.G. of samples of basic seeds meant for production of commercial seeds and drawn from the lots of the selection firms' premises. Approximately 2,500 samples are tested every year. Tests are for judging trueness of type and varietal purity. Various selections of varieties from different firms are compared together and results reported to the firms. These observations are further checked by field inspection of the multiplication fields of the same seed. When multiplication is done in the Netherlands, field inspection is done by the N.A.K.G. When multiplied abroad, the reports of the firms' own inspection are accepted. When basic seed lot is not satisfactory, it is rejected and, if it has already been multiplied, the resultant seed is rejected. Inspection of commercial seed fields is left to the firms, but they must keep records of their inspection reports for check by the N.A.K.G. The records must show details of basic seed lots used for multiplication in the different fields. A random check is also made by the N.A.K.G. particularly to ensure whether isolation requirements have been complied with.

14.24. There are no restrictions on the varieties that can be multiplied and offered for inspection as long as they are introduced with the right name and are true to variety. There is, however, the Dutch variety list of vegetable crops recommended for commercial production of vegetables. Official certification and sealing are not obligatory for vegetable seeds. The full responsibility for the quality of seeds rests with the firms which have been accepted by the N.A.K.G. and are subject to its control.

14.25 In the methods adopted by the N.A.K.G. for quality control, post control is very important. It is made at random but very intensively particularly for imported varieties. The seeds traded both by the wholesale firms (export and inland trade) and the retail firms (sold to the consumers) are controlled. In this, N.A.K.G's laboratories and its trial plots play an important role. About 8,000 to 10,000 samples of vegetable seeds and 3,000 samples of flower seeds are inspected in the laboratories of the N.A.K.G. for germination. About 3,000 to 4,000 samples are tested for trueness to variety and purity of variety in the trial gardens. In case of poor germination measures taken against the offending firm may range from official reproof or a fine to placing it under more intensive control. In case of repetition of the offence, suspension of the membership of the N.A.K.G. up to three years may be imposed. It will be noted that the system evolved, while allowing the firms considerable freedom of action to operate within the framework of regulations, provides for a system of regular and effective inspection.

Fruit Crops

14.26. Like the N.A.K. and the N.A.K.G. there is a separate organization for the control of fruit stock and non-ornamental broad-leaved trees stock like the ash, the maple, the lime tree, the poplar, the willow, the elm, the alder, the birch, the beech, the oak and others. The object of the N.A.K.B. is to promote the growing in the Netherlands of true to type and healthy nursery stock of proper quality and specified origin and to take measures to ensure that the stock reaches its destination under correct nomenclature. Under the law all nursery men, who grow woody nursery stocks coming within the purview of N.A.K.B. are legally bound to join the N.A.K.B. Members of the N.A.K.B. may sell their crops only after they have been approved by the N.A.K.B. and are provided with a N.A.K.B. certificate stating the name of the variety, the root stock and the health class. This organization has developed over the last 20 years and, as a result of the restrictions mentioned above, the fruit stocks are sold only if they have been approved by the N.A.K.B. and carry a N.A.K.B. certificate.

14.27. The N.A.K.B. is a semi-official organization working under the supervision of the Minister. It is self-supporting, the expenses being met out of the income derived from the membership or inspection fees. The Board is constituted of a Chairman (a prominent official appointed by the Minister), nursery men representing the various groups of nursery stocks, representatives of fruit growers and owners of plantations and representatives of various research institutions like the Plant Protection Service, Institute for Horticultural Plant Breeding, forest research stations, etc.

14.28. For effective performance of its functions, the N.A.K.B. has set up advisory committees for some of its sections, each with a specified task to perform. There are separate advisory bodies for (a) inspection of fruit stocks (b) inspection of strawberry plants (c) inspection of coniferous and broad-leaved nursery stock (d) ornamental trees and (e) advising on control of virus diseases. Inspection procedures vary according to the crops. Some are inspected by the Central Organization and some by the regional committees. Inspection is mainly directed towards judging trueness to type of root stocks and grafts, their health and quality. The N.A.K.B. certificates are issued only if the stocks comply with the minimum standards laid down.

Ornamental Plants

14.29. Control of quality of floricultural crops is vested with the General Netherlands Inspection Service for Ornamental plants (N.A.K.S.). The object of the N.A.K.S. is to promote the health and quality of flower crops. Under the law any grower or dealer who propagates or sells planting material of ornamental plants must be a member of the N.A.K.S. and must accept its inspection. The N.A.K.S. aims at specialization and has five sections one each for (a) Carnations (b) Chrysanthemums (c) Cyclame (d) Feusias and (e) Pelargoniums. Each section has a Committee consisting of growers and dealers. Each of the five section Committees appoints one or more representatives to the Central Committee of the N.A.K.S. These appointments are to be approved by the Minister. The Central Committee consists of growers, and dealers who are assisted by advisers from scientific institutions.

14.30. The N.A.K.S. inspection is to judge the trueness-to-type, purity and health. Every approved crop is inspected during at least one growing season to make sure that it complies with the standards set. Only the plant material of approved batches with a N.A.K.S. certificate can be marketed. Inspection of Carnations, Chrysanthemums, Cyclamen and Feusias is compulsory.

Seed Testing

14.31. Seed testing in the Netherlands is carried out mainly by the Government Seed Testing Station, Wageningen, the laboratory of the N.A.K.G. and 12 seed testing stations of the N.A.K. The N.A.K. stations carry out testing of coarse agricultural seeds such as cereals, large seeded legumes and flax. These stations adopt the same method for testing as used by the Government seed stations which are run in accordance with the I.S.T.A. rules. Uniformity in methods of testing is ensured by periodic training of personnel employed by the N.A.K., at the Government Seed Testing Station, by exchange of samples and by periodic investigations by the officials of the Government Seed Testing Station. Samples for I.S.T.A. certification, samples drawn by Govenment inspectors enforcing the Seed Act and samples of fine seeds such as grasses and beets are tested at the Seed Testing Station.

14.32. The Government Seed Testing Station, therefore, occupies a pivotal place in the seed control programme. More than 30,000 samples are tested annually and the station employs over 100 persons. Besides seed testing, the Government Seed Testing Station performs a number of other useful functions which can be summarized as under :—

(a) The station provides a micro-cleaning service to grass seed firms and growers. Grass seed firms purchasing seed from farmers for processing have their samples drawn at the time of delivery and have them tested at the Government Seed Testing Station. The analysis furnished by the seed testing station is accepted by both parties as the basis for final payment.

(b) The Station serves as a research and training centre. Officials of the N.A.K. as well as others are periodically trained. Seed testing methods are under continuous investigations.

(c) The station provides advisory service to the seed companies desirous of establishing or modernising seed processing plants. Layouts and appropriate machinery are recommended though the final responsibility for the choice of machinery in plant design is left to the seed company. This service is charged on the basis of time spent by the Institute.

(d) Investigations on seed-borne diseases are carried out.

(e) The station serves as headquarters of the International Seed Testing Association (I.S.T.A.)

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CHAPTER—15

SWEDEN

15.1. Sweden has a population of about 8 million of which 5 to 6 per cent are engaged in agriculture. There are four main agricultural regions, viz., (a) Northern Sweden, (b) forest and valley districts, (c) the plains of Central Sweden and, (d) the plains of South Sweden.

15.2. The important crops grown in Sweden are-

(a) Cereals—winter wheat, spring wheat, barley, rye and oats (white, yellow and to a small extent black);

(b) Pulses—peas, white beans, soybeans and field beans ;

(c) Oil-seeds—rape, turnip and white mustard ;

(d) Root crops—potatoes and beet root ;

(e) Forage crops—different kinds of grasses and legumes ; and

(f) Vegetables.

15.3. The growth of seed industry in Sweden can be traced back to the early half of the 19th century. It was in the first half of the 19th Century that many semi-official agricultural societies came into existence with the objective of developing agriculture. Several of these societies took up testing of new species and strains, evaluating their performance and introducing them for large scale cultivation. Seeds were also imported from other countries and farmers were taught to grow them and produce seed. The agricultural societies set up local seed testing stations mainly from their own resources but supplemented by government grants. In 1925, a Central Government Seed Testing Station was established and the small local stations were abolished with the exception of three which now operate under the supervision of the Central Seed Testing Station.

15.4. In the last two decades of the 19th century seed growers' societies were organized mainly for growing seeds of herbage plants. Cleaning and treating of seeds with proper equipment were encouraged by giving grants to the co-operatives and seed farms. Even now the Government gives grants for the establishment of seed plants in the under-developed areas of Northern Sweden. Legislation was also introduced for controlling the quality of seeds. In 1909 a decree was passed enforcing staining of imported seeds so that they could be identified. A Seed Act was passed in 1928 requiring labelling of all agricultural and vegetable seeds offered for sale. This Act was amended in 1936, 1950, 1956 and 1961. Until 1961, sealing of seeds after testing was voluntary but since then it has been made compulsory for all cereal seeds and pulses. From 1968 onwards, it would be compulsory for practically all kinds of agricultural seeds, i.e., seeds which are not officially sealed may not be traded in.

Development and Release of New Varieties

15.5. Research in plant breeding and release of new varieties is undertaken by both public and private agencies. Towards the end of the last century an important step was taken in the formation of the Swedish Seed Association at Svalof. The Association is the main public institution for research in plant breeding. It is financed by government grants, membership dues and annual payments by General Swedish Seed Company who in turn enjoy the right of multiplication of varieties bred by the Association. Breeding of sugar beet and trading in sugar beet are, however, the monopoly of the Swedish Sugar Factory Company. Work on improvement of vegetables and ornamental plants is carried on mostly by private seed firms. Universities and colleges engage themselves mainly in basic genetic research.

15.6. Breeders' rights are protected in Sweden since 1961 in respect of most crops. A levy is made on publicly marketed seeds of these crops. In order to collect the tax from all sellers it was necessary to make the sale compulsory of certified seed only. Now this will expand practically to all agricultural seeds. From the proceeds, the breeders are given royalties in proportion to the quantity of sale of seeds of their varieties. When a breeder is employed by an institution the royalty is paid to the institution. There are also arrangements to protect the rights of the breeders of other countries on a reciprocal basis.

15.7. All varieties marketed in Sweden have to be officially released. Arrangements exist for testing, indexing and performance trials and for release of varieties. The release is approved by a "Board of Original Seeds", consisting of the following for agricultural seeds :—

(a) Head of the Government Central Seed Testing Station	..	1 Chairman
(b) Research workers	..	3 Members
(c) Seed Testing Personnel	..	1 "
(d) Extension service personnel	..	3 "
(e) Farmer	..	1 "

There is a separate Board for horticultural crops with the following members :—

(a) Representatives of the Royal Agricultural College at Uppsala.

(b) Representatives of State and Central Seed Testing Stations.

(c) Commercial seed growers.

15.8. Official testing in case of horticultural crops is done by a special Division of the Royal Agricultural College at Uppsala. Testing is done at the main station at Alnarp and at different places in Sweden for a period of 2-3 years in replicated trials with earlier listed varieties as checks. Official lists of recommended varieties with full details of agricultural characteristics is published by the Board.

Arrangements for Control of quality of breeder seed

15.9. A noteworthy feature of the seed production arrangements in Sweden is the special care taken for the maintenance of purity of varieties and supply of high-quality breeder seed. The Swedish Seed Association has a Division for seed control which is responsible for the same. The first step taken is to ensure that the varieties are constant, pure and uniform. A continuous production of new elites takes place parallel to the breeding work. The characteristics of these new elites in relation to the mother variety are tested by the Central Seed Testing Station, which has to decide if a new elite can be approved or not. In many cases, the production of a new elite means a certain improvement in the variety. This is allowed within certain limits. The condition is of course that the new elite is typical of the variety. A certain improvement in agronomically important characters may be allowed. As already mentioned, the acceptability of the new elite is determined through discussions with the representatives of the State, Central Seed Testing Stations.

15.10. The Division for seed control of the Swedish Seed Association also checks the quality of breeder seed supplied to the seed company. This means careful inspection of all seeds from the time they are delivered to the seed company till the seed is sold as original seed. A new variety or a new elite of an older variety is delivered to the General Swedish Company with a document as in Appendix XI. The document together with the breeder's agreement must be signed by the Head of the Seed Association and includes an acknowledgement from the Division for seed control that the seed lot has been examined and has proved to be of high class.

15.11. The seed lot is sealed by the Division for seed control. At the same time a sample for the seed control is sent to the Central Government Seed Testing Station for control of varietal purity.

The control of breeder seed includes the following tasks :—

(a) The accurate and continuous keeping of all records of field inspections performed by the Division for seed control ;

(b) Pre- and Post-control cultivation of seed lots ;

(c) Grain sample analysis at the laboratories.

15.12. All breeder and original seeds must be field-inspected during their vegetative growth period All seed lots used by the seed company for further multiplication must be pre-controlled. This control cultivation is carried through by the Central Government Seed Testing Station. The pre-controlled cultivation consist of plots which are examined several times during the vegetative period with respect to varietal purity and also certain diseases. Only such cultivations are approved for seed which show no or a very law percentage of admixtures or diseases.

15.13. In the post-control plots, the control is performed in the same way as pre-control though a little higher content of admixtures is allowed than in the pre-controlled plots. Samples are also examined in the laboratory for varietal purity, 'freedom from admixtures, weeds, germination capacity etc. The seed is also examined for seed-borne diseases.

Production of foundation seed

15.14. The production of foundation seeds of publicly released varieties is taken up by the General Swedish Company which markets all varieties developed by Swedish Seed Association. About 100 to 200 kgs. of purified samples of new varieties or elites are handed over to this company for further multiplication. This is first multiplied on farms belonging to the company and later on contract with farmers. The control of this is still done by the breeder and the Division for seed control of the Seed Association. Multiplication of foundation seed of varieties developed by private companies is the responsibility of the company concerned.

Certified Seed Production

15.15. Most of the certified seed production of publicly released varieties is generally taken up by the Swedish Company, which has 8 farms located in different parts of the country. In addition, the company contracts over 6,000 hectares on more than 1,000 farms. The General Swedish Company has sole rights 'for processing and distribution of seeds of varieties evolved by the Swedish Seed Association. In return, it pays the Association an annual fee. The relation between the company and the Association is regulated by an agreement approved and controlled by the Swedish Government. Farmer's Co-operatives have also developed in the last three decades and organizations like the Swedish Farmers' Purchasing and Selling Association which entered the seed trade and handled a considerable part of the seed market. (The coperatives handle 50 per cent of the seed trade.)

15.16. Seed processing techniques are very advanced and the processing plants are highly mechanized. The Team visited a processing plant belonging to the General Swedish Seed Company. Briefly the process followed was to pre-clean the seeds in a linde crop cleaner for removing stones, straw, dust etc. The seeds were sampled concurrently to determine moisture, purity and germination. After pre-cleaning, the seeds are dried in linde column dryers as well as S.F. fluid bed driers. These driers have a capacity of 23 tons per hour. The dried seeds are conveyed to the seed cleaning machines, the type used was linde seed masters with a capacity of four tons per hour. The cleaned seeds are passed through kamas, table separators which complete the grading by specific gravity. When required, the seeds are treated in a casco liquid seed dressing plant, and are weighed and packed in four or five ply paper bags of 50 kgs. capacity. Normally, the bags are stored on pallets in dry and cool warehouses.

Marketing

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15.17. The Swedish trade is predominantly composed of : (a) large firms having their own plant breeding stations or connections with other plant breeding stations ; (b) seed firms buying high-quality seeds and reselling to farmers and (c) wholesale and retail dealers.

15.18. No Government control exists on procurement of seeds from farmers and on fixation of purchase or selling prices. Levels of purchase prices are the results of mutual agreements between farmers and companies and the levels of sale prices are determined by the law of supply and demand. The seed companies undertake their own promotion through sales representatives and distribute the seeds through farmers' associations—wholesalers and retailers.

Agreements for Quality Control

15.19. The arrangements for quality control in Sweden are complete and integrated and, as pointed out earlier, are governed by the Seed Act. The system of control includes governmental sealing (certification), field inspection and laboratory tests. Also, there is a control on germination and considerable emphasis on pre-control and post-control checks in the field.

15.20. The governing principle of Swedish Seed Act is that the vendor must give to the buyer all information necessary to apprise the quality of seeds offered for sale. In particular, the following information should be given :—

(a) name and address of the vendor ;
(b) kind and variety of seeds in the case of red clover, its type (late, medium or early) ;
(c) degree of purity ;
(d) content of weed seeds (number per kg.) ; and
(e) germination capacity.

15.21. It is strictly forbidden to sell seeds which do not comply with minimum requirements concerning germination, purity and maximum content of weed seeds as stated by the ordinances of the Royal Board of Agriculture.

Government Sealing (Certification)

15.22. Government sealing signifies that a seed lot which has been sampled and sealed by a representative of an official seed testing station may be supplied with the seal and the label of the testing station, provided the lot fulfils the requisites of any of the sealing classes. Government sealing is now compulsory for seeds of cereals and pulses. Seeds of other crops are not included for the present in the compulsory sealing system.

15.23. Only those varieties included in the official list of approved varieties are eligible for Government sealing. This list is reviewed and revised every year.

15.24. The grower or seed firms applying for Government sealing must satisfy the sealing authority (Government Seed Testing Laboratory) that there is sufficient storage and cleaning facilities. Such a grower or seed firm is responsible for homogeneity of the seed lot.

15.25. There are four sealing classes, namely, original seed, KOB seed, A seed and B seed. The requirements of quality for each of these classes and the method for checking the quality are briefly mentioned in Appendix XII.

Potatoes

15.26. From 1st July, 1962, Sweden has a Seed Act concerning potatoes. All seed potatoes which are publicly sold have to be controlled by the Central Seed Testing Station. This control includes the basic seed which must be certified. At least with one field inspection and one inspection of the harvested crop the tuber inspection can be made by the grower himself. At the time of selling, he must declare the name of the seller, the variety, the field inspection number, the size of the tuber and the quality of tuber.

15.27. Besides these minimum requirements for seed potatoes, there is a voluntary system of control and government sealing for potatoes. This system includes four quality classes, namely, State Seal Test, E, A & B. Only varieties approved by the Board of Original Seeds are eligible for certification as shown in Appendix XIII.

15.28. The salient features may, however, be highlighted here : (a) the control of wart disease is directed by law ; removal of potatoes and similar products is forbidden not only from infected farms but also from places within spacious protective areas surrounding them. In this protective area only wart immune varieties must be grown ; (b) the size of the field submitted for government sealing may vary from 0.5 hectare to 10 hectares. Since small fields, as a rule, are treated with greater care and attention, seed potatoes from them are often purer and healthier than those from larger fields. The total area submitted for inspection in 1962 was 2,750 hectares.

Vegetable Seeds

15.29. The control of vegetable seeds is voluntary, and is performed by the Central Seed Testing Station which supervises that seed on sale is of a given variety and in other respects fulfils stipulated requirements of germination, purity etc. The technical procedure and control measures are the same for all classes of seed except for the two highest classes. Inspection of the seed crop is essential, while for the lower two classes it is left to the traders. Since sealing of small packets of seeds is difficult and costly the seed itself is "sealed". This is done by spraying it with a non-toxic chemical solution the composition of which varies and is kept secret. On the label of each packet are stated the name and address of the firm, the name of the variety and the marking number.

The Swedish Central Seed Testing Station

15.30. The Swedish Central Seed Testing Station, Stockholm, is responsible for seed testing and government sealing programmes and for the enforcement of the Seed Act. It functions directly under the Department of Agriculture and has four branch stations. The National Board of Agriculture has also three local testing stations as part of its extension agency. It may be noted that the Central Seed Testing Station is directly responsible to the Government and not to the National Board of Agriculture. The Central Seed Testing Station has a branch which was visited by the Team. The Seed Testing Laboratory was very modern, well equipped and organized well on business lines. Seed testing and seed certification are self-supporting activities. Fees are charged for inspection, testing, tags, labels etc. and the fees received cover the expenses.

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CHAPTER—16

THE UNITED KINGDOM

16.1. The United Kingdom has a population of 30 million. The important crops grown are :—

(a) Cereals—wheat, barley, and oats.

(b) Oil seeds—rape.

(c) Root crops—potatoes, sugar-beet.

(d) Herbage crops—different kinds of grasses and legumes.

(e) Vegetables.

16.2. Agricultural research in Britain is mainly planned and coordinated by the Agricultural Research Council and is largely financed by the State. There are 14 independent research institutes in England and Wales and 8 independent research organizations in Scotland all of which receive grants and whose programmes of research are coordinated by the Agricultural Research Council. Similarly, grants are given to universities and recognized institutions. The Rohthamsted Experimental Station founded in 1843, has a long and proud tradition of agricultural research. There has been very little of research work by private firms except in the field of vegetables. The Plant Varieties and Seeds Act, 1964, however, provides considerable encouragement to private research, as it grants breeders' rights to those evolving new varieties. It must be recognized that Britain does not have extensive areas of maize, sorghum and bajra. Therefore, only a few hybrids exist so that the built in exclusiveness, which hybrid seed producing companies have, does not exist and hence the need has arisen for special protection of breeders' rights by law.

Indexing, Testing and Release of Varieties

16.3. To help give breeders an exclusive right on varieties developed by them the Seeds Act was modified in 1964. The Act of 1964 lays down detailed regulations relating to breeders' rights, statutory trials and indexing of varieties based on which breeders' rights can be granted. A Plant Varieties Rights Office, constituted under the Act is responsible for enforcing the regulations under the Act. This Office acts in close coordination with the National Institute of Agricultural Botany which carries out the tests required by the Controller of the Plant Varieties Rights Office, and advises the inclusion or otherwise of any variety in a statutory Index.

16.4. Under the 1964 Act, no seeds can be sold unless the variety is included in the statutory index of varieties and has been on trial at least for a minimum period of 2 years. A variety for inclusion in the statutory index must fulfil the following conditions :—

(a) *Distinctness.*—The variety must be clearly distinguishable by one or more important morphological, physiological or other characteristics from all other varieties whose existence is a matter of common knowledge at the time of application. Common knowledge may be established by reference to varieties which are already under cultivation or on the market, or in a botanical reference collection.

(b) *Stability.*—The variety must be stable in its essential characteristics. It must remain true to its description after reproduction or propagation, or where a particular cycle of reproduction or multiplication is specified by the applicant, at the end of each cycle.

(c) *Uniformity.*—The variety must be sufficiently uniform or homogeneous having regard to particular features of its sexual reproduction or vegetative propagation.

16.5. All applicants for breeders' rights are required to give detailed information and submit such records as are necessary and afford the Controller of Plant Varieties Rights Office all facilities for inspection of plant material and trial as the Controller may, from time to time, require. The Controller will make arrangements for carrying out necessary tests to determine whether the variety is distinct, stable and uniform. The trials will normally take two years. While the trials are on, the applicant may obtain a protective direction giving an undertaking that pending the decision on the application for plant breeders' rights, he will not offer for sale in the U.K., planting material derived from the plants of his variety. Fees are charged for application for breeders' rights, as well as for conducting trials according to the schedule prescribed. If the variety satisfied the conditions enumerated above, the applicant is granted breeders' rights whereby he is given the exclusive rights (a) to produce the reproductive materials of the protected variety in the U.K. for the purpose of selling it, (b) to enjoy sole selling rights for the reproductive material of the protected variety, (c) to exercise any further rights as specified under the Plant Breeders' Rights Scheme.

16.6. The plant breeders' rights are exercisable only in the U.K. For protection in any other country, a separate grant of rights must be obtained. Reciprocal arrangements exist betwen the signatory nations, of the International Convention for the Protection of new Varieties of Plants, Paris 1961.

16.7. The National Institute of Agricultural Botany is associated largely with the implementation of the statutory measures under the Plant Varieties and Seeds Act. Trials are conducted under the supervision of technical committees on which representation is given also to advisory officers, Government officials, millers, etc.

16.8. Once the breeders' rights are granted, the breeder is free to fix the level of royalty. Normally, the royalty would average around 10 per cent of the value of seeds, and an association of breeders usually regulates the rates. The Government is responsible to see that the breeders maintain the purity of the variety. If the breeder is unreasonable the Government has rights under the Act to step in and issue compulsory licence. Only officially recognized names can be used by the breeder. Two types of licences are granted; in one type of licence royalty is paid on seeds produced and in the second type, royalty is paid on the seeds actually sold.

16 9. With the incentive provided by recognition of the breeders' rights, private research is developing and groups of seed firms are tending to come together to employ specialists. This also helps public institutions to do more fundamental work, and to engage themselves in areas which are not economic to private research.

Foundation Seeds

16.10. Until recently, the responsibility for production of foundation seeds of public research institutes was vested with the National Institute of Agricultural Botany. Recently, however, the National Seed Development Organization Limited has been established as a limited company under the Companies' Act. The objective of this organization is to develop in the U.K. and abroad, plant varieties resulting from research carried out by Government departments or other public bodies or any other research in the U.K. The National Seed Development Organization will have regard to the needs of farmers and will operate on commercial lines. It is financed initially by a treasury loan and the profits of the organization will go to the Exchequer. Income will be derived from the sale of seeds and royalties payable in respect of plant varieties for which public plant breeders are granted rights. The actual multiplication of foundation seeds was being handled by a separate division of National Institute of Agricultural Botany. This work will be carried on by the National Institute as an agency of the N.S.D.O. The foundation seeds would be distributed to the seed trade and farmers who undertake to participate in the certification scheme. No supplies will be made to the producers of seeds who do not agree to the certification of their produce. This assures, control of the variety under the breeders' rights programme.

16 11. The processing plant of the foundation seed division of the N.S.D.O. was visited by th Team. This is a modern plant similar to those operated in Europe. Grain seeds are dried in horizontal bed driers which are heated by injection of heated air under controlled conditions. There is gradual movement of seeds so that they are dried to the desired moisture level. Grain seeds are given hot water treatment for control of seed-borne diseases like loose smut. Foundation seeds are stored in the case of some vegetable varieties for as long as 10 years in specially designed rooms where temperature is maintained at 0°C.

Seed Testing

16 12. There are three main testing stations—one in Cambridge for England and Wales, one in Edinburg for Scotland and one in Belfast for Northern Ireland. The station at Cambridge handles about 50,000 samples a year, and employs about 50 analysts. Besides these individual tests, the station carries out tests of controlled samples received from licensed stations of which there are over 130 in England and Wales alone, 60 of them being engaged in cereal testing. Licensed seed testing laboratories are largely those operated by private seed firms. Farmers may also send samples for test at subsidised rates. The Government testing stations also provide regular training of analysts employed by them as well as private stations.

Seed Marketing

16 13. As in the European countries, the marketing and distribution of seeds is mainly in the hands of private trade. There are no Governmental regulations on prices to be paid to growers or on sale prices. Normal commercial channels are used for distribution. The seed trade is well organized and the Seed Trade Association of the U.K. plays an active role in developing a healthy seed trade.

16 14. The earliest legislation in the United Kingdom for controlling seeds can be traced to 1869, but it was in 1917 that the first seed testing organization was established and it was in 1920 that the Seeds Act was passed. This was a legislation giving powers to the Government to frame regulations which were

first made in 1922. This Act was amended in 1925 and again in 1954, and the provisions of the original and amended Acts apply to all the principal kinds of seeds of cereals, grasses, clovers, root crops, vegetables and seed potatoes. The main object of this Act is to require the sellers to give a statutory declaration to purchasers within 7 days of sale or delivery giving those facts such as purity, germination, which enable the merits of the seeds to be assessed with some degree of accuracy. These particulars must also be displayed conspicuously on seeds exposed for sale and seeds in packets. The statutory seed year runs from the 1st August of the same seed year, except that the analysis particulars of seed sold and delivered or exposed for sale during August and September may be based on tests made since 1st August of the previous seed year. Tests for the purposes of Seeds Act, 1920 must be made either at one of the official seed testing stations or at a private seed testing station licensed by the Ministry. Licences for private seed testing stations are granted solely for purposes of the licensee's own purchases and sales. While no standards are laid down for seeds that can be marketed, for the purpose of making statutory declaration there are standards for purity and germination, which must be specified. There is no restriction on the buyers to buy what they like. Only minimum standards are prescribed and, if the analysis shows that the standards are above the declarable minimum, these need not be declared and a mere statement that these are above the declarable minimum is sufficient.

16.15. Over the years, however, it has been found that Government's control on genetic purity had to be increased. In order to ensure that the genetic purity is maintained and sufficient control can be exercised by the Government, an Act entitled "Plant Varieties and Seed Act"—1964 was passed. This Act and the earlier legislation relating to control of quality now govern the situation in the seed industry.

16.16. There is also a comprehensive scheme of certification in force. This scheme is voluntary and is restricted to varieties which are declared eligible for certification by the certifying authority. The objects of the certification scheme are :—

(a) To encourage the production of high quality seed of approved varieties and give a procedure which will reasonably ensure the authenticity and varietal purity of the seed produced.

(b) To arrange for such checks through seed crop inspection and tests of seed samples which will show whether the scheme is functioning satisfactorily.

(c) To provide for the use of a certified "Trade Mark" for seeds certified under the scheme.

16.17. The certifying authority consists of a Chairman appointed by the Ministry of Agriculture, Fisheries and Food, four members nominated by the seed trade, four members nominated by the seed growers, the Directors of the Welsh Plant Breeding Station, Grassland Research Institute, National Institute of Agricultural Botany and Scottish Society for Research in Plant Breeding and a member from the National Agricultural Advisory Service under the Ministry of Agriculture. To be eligible for certification, crops shall be grown from the basic seed, i.e., for a bred variety, seed issued or approved by the breeder or his accredited agent and for a local variety approved by the certifying authority for unrestricted further multiplication. The basic seed shall be officially labelled and sealed and the certifying authority shall satisfy itself by such enquiries as it may think necessary with regrd to the authenticity and genetic purity of each lot of basic seed. Crops submitted for inspection shall normally be visited and inspected once before harvest by a trained Inspector on behalf of the certifying authority following the procedure for inspection laid down by the certifying authority. If necessary, additional visits or inspections may be made. If a crop is rejected for any reason as a result of crop inspection, no seed harvested will be eligible for certification under any circumstances. It is the responsibility of the grower to ensure that the produce of individual crops is kept separate while in his possession, so that it would be given an identity number and defined.

16.18. Processing shall be done only by an "approved processor", who has adequate facilities for cleaning and processing of seeds according to the standards of the scheme, trained staff and adequate storage space to maintain the proper identity of seed lots. The grower himself may process his produce, but his facilities for processing must be approved by the certifying authority. When seed is delivered to a contract processor, it must carry authorised 'uncleaned seed' labels showing the species, variety and crop identity number, so that a representative sample can be drawn at the approved processors' warehouse. On receipt of the seed lots with the growers' declaration, the seed is processed to the standards laid down, labelled and sealed with the authorised 'certified seed' labels. The label should show clearly the crop identity number and processor's own number. As a further check, sample of certified seeds are grown in post control farms, to ensure that the certified seed lots are upto expected standards. Approximately 20 per cent is thus checked.

16.19. For cereals there are two schemes of certification :—
(a) Comprehensive certification of seeds of first generation.
(b) Multiplication seed scheme on the basis of fields approved for inspection.

16.20. Inspection in the case of the former, is done only by official inspectors. In the latter case firms' inspectors can carry out inspection, but these are generally trained by the N.I.A.B. It is proposed to unify these two schemes in 1969. There are no restrictions on the number of generations cereal seed can be multiplied but for straight pure line varieties, the normal span for basic seed is about 5 years. Approximately 50 per cent of cereal seeds in usage and 75 per cent in the case of herbage seeds are certified. In the case of state bred varieties of vegetables, 100 per cent is certified in some cases and practically none in other varieties. Certification in the U.K. is concentrated on maintaining varietal purity so as to ensure that the farmer gets the true variety.

Seed Regulations

16.21. Section 16 of the Plant Varieties and Seeds Act, 1964, empowers the Government to make regulations for (a) ensuring that reliable and adequate information is afforded as to the nature, condition and quality of seeds which are sold or are for sale ; (b) preventing the sale of seeds which are deleterious and preventing the sale of seeds which have not been tested for purity and germination or which are of a variety, the performance of which has not been subjected to trials ; (c) preventing the spread of plant diseases by the sale of seeds ; and (d) regulating the descriptions under which seeds are sold. Under these regulations, Government may, require information to be given in a prescribed manner or prohibit the sale or offer for sale of certain seeds containing more than the prescribed percentage of weed seeds or require persons who deal in seeds to keep records or require persons growing seeds to furnish information on acreages sown and yields of the crops or regulate the procedure for seed testing.

16.22. Under the Seed Regulations, 1961, persons delivering seeds are required to give a statement in writing to the purchaser certain information on purity, germination, etc., depending on each type of seed. Wherever seeds are sold, these particulars must be displayed conspicuously. The statutory seed year runs from the 31st August, to the 31st July. Seeds sold or delivered during this period must have been tested after the 1st August of the same seed year except that analysis particulars of seeds sold during August and September may be based on tests made before 1st August of the previous seed year.

16.23. No minimum standards are laid down for most of the seeds but there are detailed regulations requiring the indication of the actual percentage of germination, purity treatment material, etc. In case of root crops and vegetables certain minimum standards of purity and germination are also prescribed. Where the percentage is less than the prescribed minimum the actual percentage has to be indicated. For packet seeds, not exceeding 2 lbs. in the case of peas and beans, 8 ounces in the case of mustard, rape, spinach, beet root, radish and turnip and two ounces for any other root and vegetable seeds, it is enough if it is stated that purity and germination are not less than the prescribed minimum declarable percentage.

16.24. Two special aspects of the seed legislation in England are the provisions relating to control of imports and the measures for preventing injurious cross-pollination.

16.25. As regards imports, Government is empowered to regulate the same by licensing. As regards cross-pollination, Government may order that certain types and varieties of plants are protected for certain areas and in the same area may control the growing of certain crops and plants which may contaminate the protected crop. Government may direct the owner of a land to remove the contaminating crops. This provision is of special interest to India where problems of isolation are being faced increasingly in hybrid seed production. It may, however, be mentioned that the provisions relating to isolation apply mostly to highly cross-pollinated vegetable crops.

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CHAPTER—17

THE U. S. A.

17.1. The Team spent the major part of its time in the United States which has made great strides in evolving outstanding varieties and hybrids. The United States, like India, has a highly diversified agriculture, under varying agro-climatic conditions. Many of the problems in the United States are similar to those in India. Among the countries visited, the United States is the only one to have a large hybrid programme in maize and sorghum.

17.2. The research effort in crop breeding in the United States is shared by Federal research stations, agricultural universities in the States and recently by research departments of private major seed companies. The remarkable strides made in agricultural production in the United States is indicative of the success of their research and allied efforts in that country. Certain trends are clearly noticeable in respect of research activities in the United States. The public institutions are beginning to concentrate increasingly on fundamental research in breeding procedures and in evolving basic genetic material. Applied research in breeding in evolving new varieties is now taken up to a great extent by private seed companies. This trend is particularly evident in hybrids of maize, sorghum and vegetables. Private organizations are just starting breeding programmes in wheat and other self-pollinated crops. The number of private breeders undertaking research work in the field of vegetables was indicated as 15 while the figure was 24 for maize and 20 for sorghum. However, in relatively underdeveloped States like Nebraska, the State Government and the agricultural universities do the major portion of applied research in plant breeding.

17.3 The growth of seed industry in the United States can be traced back to the beginning of this century. In 1898, a law was passed for the first time to prevent the sale of seeds adulterated with weeds seeds. In course of time, legislation was enacted in different States. In 1922 a law was passed by the Congress prohibiting import of low quality seeds. In 1926, a law was passed to regulate inter-State commerce prohibiting false labelling. A seed industry has developed over the years dealing in seeds of hybrids, vegetables, grasses, soybean and other crops. There are a large number of seed companies and organizations of different structures and sizes. Many small firms flourish along with large companies. Generally the large seed companies have their own research departments and strong marketing departments relying mainly on their own research efforts for evolving superior varieties.

Release of New Varieties

17.4. There are no restrictions or regulations in law on the release of new varieties. There is no system of compulsory registration of varieties or of release of varieties. The public as well as the private institutions including those engaged in research in plant breeding have their own committees which scrutinize and evaluate new varieties. Subject to this, the release of a variety is the responsibility of the institution undertaking research.

17.5. There is no system of breeders' rights yet introduced in the United States. The patent laws relating to plants provide for granting of patents only to those who have invented or discovered and reproduced a distinct and new variety of plant other than a tuber-propagated plant.

Arrangements for Breeder and Foundation Seed Production

17.6. Varieties, hybrids and inbred lines of field crops developed by public research agencies are released through foundation seed production programmes which are of three types :—

(a) Projects operating within a State Agricultural Experiment Station or Government Agency ;
(b) Private organizations directed by persons from public agencies ;
(c) Federal Government foundation seed programme.

17.7. The State foundation seed programmes that are part of the work of an Agricultural Experiment Station are sometimes assigned to a specific department. In some States, the Departments of Agronomy supervise the foundation seed programme. In some other States, the foundation seed project operates under the direction of the Director of Experiment Station. Funds to cover production, processing, storage and distribution, foundation seed and related expenses are made available from State appropriations or from sales of seed or from both. But usually foundation seed operations are self-financing once they are started.

17.8. In a few States, foundation seed organizations are non-profit corporations whose Directors include members of the staff of experiment station, extension service and seed producers. In some other States, foundation seed is produced by grower co-operatives or other forms of non-profit co-operatives, 17.9. For example, in India, an organization called the Agricultural Alumni Seed Improvement Association Inc. was formed by the Alumni of the University and has an agreement with the Purdue University. Under this agreement, it has sole rights for multiplying foundation seeds of varieties evolved by the University. In return for this privilege, the Association pays a fixed sum which is earmarked for crop research. Additionally, the Association also makes an annual grant to the University. The Association is solely run on income derived from sale of foundation seed and payments for services rendered. There is no subsidy of any kind. There is no division of profits among the members and no Federal income-tax is paid. Any profit left after meeting expenses and payment of royalty to the University is retained and used to meet capital expenditure, cost of expansion of services etc. The Association organizes production on its own farms (about 800 acres and on farms which are leased from farmers on one-year or 5-year basis). It has its own processing and storage facilities. Certification is done by an independent agency for the State—the Indiana Crop Improvement Association.

17.10. As a deterrent policy to prevent unscrupulous elements making a hay, only single crosses are sold and not inbreds. Small quantities of inbred seeds are sold by the University only after a hybrid derived from them is released. Foundation seed is open to all organizations—big and small. Sales in the first year of release of a new variety are, however, restricted to seedsmen of India who have established a good 3-year record of seed certification service. The allotment in the first year is made by the Department of Agronomy of the University according to a pre-determined policy and the quantity of seed available. There are no such restrictions in later years.

17.11. In the State of Illinois, there is a similar organization called the Illinois Foundation Seed Inc. The seed growers of Illinois are the members. It was set up in 1937. This organization does not own farms but relies mainly on contract with farmers. It generally produces 50 to 60 per cent over the estimated requirements to provide a carry-over for succeeding years. The organization normally works with small and medium sized enterprises who do not have breeding programmes of their own or arrangements for multiplication of foundation seeds. Certification is done by the Illinois Crop Improvement Association. In return, for the right of propagating varieties developed by public research and advisory service rendered by the University, the organization pays a fixed sum annually to the University. Unlike the organization in Indiana, this institution distributes its profits to members according to the volume of business received from them and also pays Federal income-tax.

17.12. In Nebraska, the foundation seed production centre is under the University of Nebraska. It is a self-supporting branch of the University and any profits are ploughed back for research purposes. It works under the guidance of the Agronomy Department of the University. It has a monopoly for foundation seed production of varieties bred at the University. The allocation of foundation seed is done by a committee composed of the Chairman of the Agronomy Department, four Plant Breeders, a representative of the Crop Improvement Association and a representative of the Dean of the Agricultural College. This is done on the basis of the experience of farmers in the production of seeds under consideration. For this purpose, seed growers are classified under five groups :—

(a) Growers who had grown certified seed of the crop released in each of the three previous years ;

(b) Growers who had grown the certified seed of the crop in two of the past three years ;

(c) Growers who had grown certified seed of the crop at least once in the past two years ;

(d) Growers who had applied for certification of any crop within the last three years ; and

(e) Others.

17.13. In actual allocation, a unit allocation system is used, the minimum size of the units being fixed at what is considered to be the smallest economic unit for the crop under consideration. The number of units to be allocated to each class of growers will depend on the crop, variety, the quantity of seed to be supplied and the number of requests.

17.14. In California, the Agronomy Department of the University of California, Davis, produces foundation seeds of varieties bred by the University and approved by the Technical Committee of the Agronomy Department.

Pricing of Foundation Seeds

17.15. All the organizations visited mentioned that the pricing of foundation seeds is done on the basis of market conditions and not on the basis of fixing of any particular margin. However, the prices have been reasonably stable over the years. The prices of single crosses of maize range between $ .75 to 1.25 per

TVK in Illinois and from $ .95 to 1.75 in Indiana (Rs. 18 to Rs. 48 per kilo against maize grain price of 30 paise per kilo). At both the places, volume discounts are allowed ranging from 25% to 50% depending on the quantity ordered. The policy of the foundation seed organization is not to sell inbred lines but only single crosses in respect of hybrids. Inbred seeds in small 100 kernel quantities are available from universities for research and breeding programmes only. Most of the hybrids even in respect of maize are based on sterile female lines and the sale of single crosses is, therefore, of three types—(1) Cytoplasmic male steriles ; (2) Pollen restorer single crosses; and (3) Regular single crosses. Of the States visited, only Nebraska had sizeable quantities of sorghum foundation seed. The sale prices are as under :—

Sorghum .. 85 cents per lb. for sterile line. (Approx. Rs 14 per Kg.)
25 cents per lb. for pollinator (Rs. 4 12 per Kg.)
(As against grain price of sorghum, viz., 47 Paise per Kg.)

17.16. In Nebraska the entire production is organized by the University. There is no contract with farmers. Considerable importance is attached to the field testing of sorghum foundation seed. This is arranged in the off-season in Texas and Mexico.

17.17. The United States has also a National Foundation Seed Project for supplying the foundation seeds of certain crops where the production areas and the consuming areas for the seeds are widely separated. This is a part of the Agricultural Research Service Organization of the U.S. Department of Agriculture. The foundation seed programme is presently limited to forages and legumes and is worked out in conjunction with the State certifying agencies and seed associations. This scheme is intended to ensure an adequate supply of foundation seeds for production of certified seeds particularly of new varieties that are developed by the public breeding institutions. The project, as stated above, is concerned with grasses and legumes only, as cereal seeds are generally grown in adequate quantities by the State where they are used and where a certain amount of specialization is needed to produce good quality forage seeds. Breeder seed stocks are provided by the breeding institutions. Multiplication is arranged with the assistance of seed certifying agencies, qualified seed growers and the seed trade under Government contracts. Funds required for implementing this programme are provided by the Commodity Credit Corporation.

17.18. A National Advisory Committee guides and formulates the general policy for foundation seed production and its distribution. The Committee consists of 8 members and 8 alternates with equal representation for the seed trade (American Seed Trade Association), Agricultural Experiment Stations, State seed certification agencies and the Federal Government. Quantity of seed to be produced, areas where they are to be produced, the prices to be paid to growers and the prices at which the seeds are to be sold are determined by the Committee. The members hold office for two years and are generally succeeded by their alternates. The Advisory Committee is headed by a reputed agricultural scientist.

17.19. The foundation seed production areas are strictly determined on technical grounds as to best suited soils, climate, processing facilities and past experience of seed growers to produce a particular crop's seed of the highest quality. For example, the bulk of the foundation seeds of forages and legumes is now produced in California because of the fertile loamy soils with good drainage and irrigation facilities and climatic conditions like bright sunny weather obtaining there at the time of harvest. This organization does not have its own farms or processing plants. Production is, therefore, organized by contracting with good growers, who are selected on the basis of their past record. Contract growers arrange with the seed firms, who have the necessary facilities, for the processing of the crops. The State certifying agency of the producing State arranges for the certification before the stock is allocated to other States for distribution. Storage facilities available with the trade are also made use of by this organization.

17.20. Distribution among the States is done on the advice of the National Advisory Committee. Before planning the production, the States and the seed trade are consulted as to their requirements which the organization endeavours to meet. To safeguard against shortages arising due to unusual weather conditions, the organization carries large reserves of stocks sufficient for 1 to 3 years on the basis of estimated demand. This policy also ensures a stable price level. The organization operates on a no-profit-no-loss basis and hence prices are kept at a reasonable level. It was indicated that the foundation seed price is about double that of certified seed. Extremely high genetic purity is maintained by using only breeder seed to produce foundation seed. Foundation seed is not used to produce another generation of foundation seed nor is certified seed used to produce another generation of certified seed. Tests have shown some degeneration especially of some legume crops in each succeeding generation. Therefore, each crop is judged in this regard on its own.

Arrangements for seed production and marketing

17.21. The United States is an example where the production and distribution of certified seed is operated almost entirely on commercial principles by private firms. A strong seed industry has been developed over a long period of producing and merchandizing high-quality seeds. The number and type of firms in the seed industry vary very widely as also the types of activities undertaken by the different firms. In the field of hybrids, there are a number of large companies undertaking their own research as already pointed out. The Team had the opportunity to visit two such large firms, viz., the DEKALB LTD. and the PIONEER LTD., both of whom have specialized in hybrid maize, hybrid sorghum and hybrid chicken. There are also other large companies like Northrup King and Asgrows, who deal in vegetable seeds as well as in hybrids. The Team also visited a large number of small and medium-sized companies and some co-operatives. It is noticed that there is a tendency for the smaller firms to give place to large firms or become their subsidiaries. Still, a number of small firms are able to hold their own and compete successfully with the larger firms. Some of the smaller firms are coming together for purposes of undertaking research, marketing and other common operations.

17.22. The seed production arrangements vary from company to company ; the arrangements of production and marketing of various typical institutions visited by the Team are briefly indicated below :—

(a) The Indiana Farming Bureau Co-operative Association is an apex organization affiliated with 85 county co-operatives (retail associations with about 1,20,000 farmer members). The fore-runner of this organization was started in 1920 mainly with the objective of purchasing and distributing to the farmers inputs like fertilizers, coal, seeds, etc. This co-operative entered the seed programme during the same year to provide farmers with reliable source of hardy and adapted seeds of legumes of known origin which were not easily produced in that area. Its seed programme still concentrates on those legumes and grasses not grown in the area. Initially, some seeds were purchased from other local sources and distributed to members. In 1926, the co-operative began to process its own seed and a processing plant was bought in 1945. More recently it has been working with other State co-operatives on a programme of research on legumes and grasses. The co-operative distributes the seeds through county co-operatives who employ their own managerial service and sales staff. The county co-operatives make their own arrangements locally for the supply of hybrid and other seeds produced in the State.

(b) Another typical co-operative organization is the N.C.+ Hybrids at Lincoln, Nebraska. This organization was founded by a group of farmer-producers who decided to join hands when they met with difficulty in marketing their seeds in competition with the larger firms. This is a co-operative organization registered under the Nebraska Co-operative Law and is not connected with the Government or the university. Operations are financed by the capital subscribed by member growers as membership fee. Ownership is proportionate to acreage under production. Membership fee is fixed at $25 per member. Equity capital (otherwise called acreage fees) is raised at the rate of $10 per acre under production. For financing the buildings and equipment, debentures carrying 5per cent interest are issued. Additional borrowings from co-operative banks and retained profits are employed for financing their operation. The net savings, after providing for depreciation, obsolescence, bad debts or contingent losses and allocation to reserves, are distributed in proportion to the business that members have done with the co-operative. Production is organized in February and quotas are fixed for each farmer-member. Farmers may process the seeds in their own plants. Smaller growers deliver uncleaned seeds to the co-operative's plant. Growers are paid part of the price and further amounts are paid as quickly as possible. Growers are not guaranteed initially the quantum of payment to be made. It will be the endeavour of the organization to sell at the best possible prices and distribute the surplus after meeting overhead expenses.

(c) Another typical marketing co-operative is located in California. The name of this organization is the CALADINO Farm Seeds Inc. It grew out of a need of legume and grass seed growers whose produce had to be marketed 2/3rds of the way across the country in other States. The main characteristics of this organization are :—

(i) Farmer-growers are required to sign a 15-year membership or marketing agreement which binds them to deliver all or a specific portion of their production of the specified crop to the co-operative. This arrangement ensures availability of a sufficient volume to the co-operative to meet their established demands.

(ii) A system of pooling called 'Single Pool Operation' is adopted. Under this system after the material is graded and members' production pooled, each member is being credited with the volume delivered by him of a particular grade. This is a risk-spreading technique whereby the members share in price fluctuations some of which may be caused by extranears circumstances such as weather, natural disasters, etc., and the returns are equitably shared

(iii) Payment for the produce delivered is made in instalments as sales made to the co-operative at the time of delivery of stock are only made over to the organization for selling at the best price obtainable. At the time of delivery depending upon the commodity and the marketing interval, the grower receives an advance of about 60 per cent of the anticipated return. As and when sales are made, further payments are effected. When the entire lot is sold and the total receipts are computed, final settlement is made to the grower. Under this system, a grower producing a crop that is marketed over a lengthy period of time has a sizeable amount of his earnings tied up with this co-operative. This has the effect of drawing the grower closer to his business than in cases where they sell to proprietory outlets for cash. Most growers usually plan their financing to allow for a deferred payment schedule.

(iv) Part of the working capital is derived by withholding an amount from each member's return and crediting to a revolving fund. This is often worked out on a per unit basis and the contribution to the revolving fund by the individual member is in proportion to the services rendered to him by the co-operative.

(v) This capital is used for purchase of land, building, equipment or as operating capital. A cycle is established whereby the money is returned to the member after a specified interval of time, which is roughly about six years. Under this system an active member invests money in his co-operative every year and provided he continues as a member for the full term of the agreement, starts receiving payments from the above revolving fund regularly.

(vi) This system has the advantage that ownership tends to be concentrated among the members actively patronising the co-operative and the member's investment is in direct proportion to his use of the services of the co-operative. This has the further advantage that by adjusting the amount withheld and/or the length of the cycle for which these amounts are retained, the size of the co-operative's fund can be regulated to suit the needs of the business.

(vii) The CALADINO Farm Seeds Inc. has its processing plant. Total acreage of the members as well as some non-members whose production is processed at this plant is about 38,000. Contracts are entered into with non-members where seeds of a variety grown by the members or a larger volume of seeds of the same variety grown by the members is needed. In the case of contracts with non-members the profits earned are subject to tax and the balance of surplus is distributed to the members. Forty per cent of the volume is exported. Some varieties are certified under the O.E.C.D. Scheme.

17.23. *Private Firms.*—Some of the firms visited by the Team were as under :—

(a) Large-sized companies :

(i) Dekalb Agricultural Association, Dekalb, Illinois.

(ii) Funk Bros., Bloomington, Illinois.

(iii) Pioneer Hi-Bred Corn Company, Des Moines, Iowa.

(iv) Pioneer Seeds Company, Tipton, Indiana.

(v) Asgrow Seeds Company Inc., Oxford, Indiana.

(vi) Ferry-Morse Seed Co. Inc., Mountain View, California.

(vii) Waldo Rohnest Co., Hollister, California.

(viii) S.R.S. Seeds, Niagara Chem. Division, Modesto, California.

(ix) Sawan-Division of W.R. GRACE & Co., Columbus, Mississippi.

(b) Medium-sized and Smaller Companies :

(i) The Moews Co. Boswell, Indiana.

(ii) Mitchell Farms, Windfall, Indiana.

(iii) Adlers Seeds Inc. Sharpville, Indiana.

(iv) Walter J. Harpel Seeds Co. (Migro).

(v) A.L. Castel Inc. Morgan Hill, California.

17.24. The larger companies have an integrated organization with a well-developed research and breeding programme and they mainly concentrate in developing hybrids. While many of them have their own farms attached to their research stations, production on their own farms is normally confined to breeder and foundation seeds. The bulk of the production for the market is arranged principally through contract with farmers who provide the land and necessary facilities. Generally in the case of corn, sales forecasts of each hybrid by locations are made in January and February of each year and the quantities of the hybrid to be produced are worked out. Some of the largear companies use a linear computer programme to schedule the quantities of each hybrid to be produced in each plant at the lowest cost of production and to support sales estimates. Contracts are then entered into with the farmers to achieve the required acreage for cultivation. Generally, these contracts are made approximately a year in advance of the season when actual deliveries of commercial seeds are to be made to the farmers.

17.25. For production of foundation seeds the terms of contract provide for cultivation under the direct supervision of the company and payment of a lump sum per acre to the farmer. In the case of corn a sum of $110 to $115 per acre was indicated by one company. The entire produce is taken over by the company for processing and distribution. Costs of cultivation are to be met by the farmers while the company supplies the breeder seed. The payment is so fixed that the farmer receives a better return than that which could be earned by cultivation of a normal crop.

17.26. For production of other (non-hybrids) seeds for supply to farmers, the companies generally supply the foundation seeds which in some cases are paid for in cash or returned in kind by an equivalent quantity of seeds. While some companies pay on the basis of the Board of Trade published prices for future contracts, other companies provide a specific premium of about 30 cents per bushel equivalent to 25 per cent over the grain prices ruling in the market at the time of delivery or obtaining at any particular time between November and April. Prices are usually high in the spring and the bulk of the settlements are made then. Some companies adopt a different procedure and pay on the final yield of processed seeds. Here again, the price is worked out to yield a slightly better return than that would be obtained by growing a normal crop. On single crosses the price paid works out to about three times the grain price and on double crosses about twice the grain price. Farmers have to bear all cultivation costs, but the companies may pay for detasseling, roguing and other similar costs.

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Payment to contract growers	..	$2.00 per bushel.
Detasseling costs	..	$0.75 " "
Cost of foundation seeds	..	$0.25 " "
Research expenses	..	$0.20 " "
Processing expenses	..	$1.50 " "
Transportation costs	..	$1.05 " "
Total	..	$5.75 " "
Taxes, manufacturing overheads	..	
Sales promotion and profit..	..	$4.17 per bushel.
Total	..	$9.92 per bushel.

17.27. The retail selling price was indicated for this type of seed as $13.00 per bushel, providing a margin of 30 per cent to distributors/dealers. The above pattern of costing seemed typical of large-sized companies.

Seed Processing

17.28. The United States is highly advanced in respect of seed processing. The production areas are scattered and each area has a processing plant located centrally. Around each plant the seed production area is approximately 1000 to 6000 acres. The acreage contracted is normally within a radius of 40-50 miles. The type of plant and the type of machinery used vary widely according to the size of the plant and the number of crops handled. It was noted that many seed companies had adopted and improvized their plants according to their requirements. Many types of sophisticated cleaning equipment were used. These included magnetic separators, aspirators, specific gravity separators and electronic eye-sorters. Processing of hybrid maize in the United States requires separation into a number of sizes and grades to help precise mechanical planting. One of the vegetable firms is trying to overcome the problem of seed spacing by introduction of tape planting. This experiment taken up in collaboration with Union Carbide Co. aims at providing the farmers with water soluble tapes in which seeds are spaced at appropriate distances. Considerable strides have also been made in California in vegetable seed processing.

17.29. To assist the firms to keep pace with seed technology and testing methods, there are institutions to provide the requisite services. In Mississippi State, the State University Seed Technology Laboratory provides services to companies that do not have resources to have their own engineering and training facilities. The programme has three different aspects, viz., research, training and technical service. The Seed Technology Laboratory concentrates on problems relating to production, processing, packaging quality evaluation, marketing and distribution, methods of storage, packing and drying to maintain viability of seed. In the training area they conduct courses for seedsmen engaged in selling seeds. Emphasis is on commercial aspects of production, cleaning, processing, handling machinery development, seed treatment and drying. Companies may refer problems to this institute, who will then carry out tests and render proper service. They also provide service regarding plant lay-out, processing methods, storage etc. Firms in the United States are not charged for these services. Requests from other countries are also attended to. These may be routed through the AID authorities since the laboratory has a world-wide contact with the U.S.A.I.D.

17.30. Another organization which provides service on a commercial basis is the Corn States Inc. in Iowa State. This Company assists firms by drawing up plans, designing and engineering of plants. They supply all types of equipment for processing, etc. If the companies buy a plant from them, they charge only the cost and collect the engineering fee for designing plant layout etc. This firm indicated that engineering and architectural fees would be ten per cent of the machinery cost.

17.31. The Team visited Messrs A.T. Ferrell and Co., Michigan who specialize in the manufacture of seed cleaning equipment and in recent times have started manufacturing grain dryers as well. This firm has vast experience in this field and markets its cleaners under the brand name 'Clipper' which are largely used in the U.S.A. It was indicated by this firm that they have companies with licence in France and Australia, to manufacture 'Clipper' cleaners. Under agreements with these companies, Messrs A.T. Ferrell & Co. provides technical guidance and training of personnel in return for payment of 5 per cent royalty on sales.

Quality Control

17.32. Seed Laws in the U.S.A. have been drafted to ensure truthful labelling. They have been designed not only to protect the consumers of seeds but also the seedsmen.

17.33. The first legislation was passed by the State of Connecticut in 1921. Other States followed so that by 1941 all of the States had seed legislation. In the early 1900's the Federal Government enacted legislation to meet specific needs.

17.34. The Federal and State Seed Laws contain similar requirements with regard to truthful labelling. However, as a result of their being enacted at various times by different groups, considerable variation has occurred. Attempts have been made to achieve greater uniformity by developing a suggested uniform Seed Law that States might adopt or utilize as they considered revising their existing legislations. Therefore, it has been possible to achieve more and more uniformity through the years. Basically, the States' Acts deal with seeds that are sold within the particular State. The Federal Act comes into play only when seeds cross a State line. It is, therefore, designed to ensure the proper labelling of seeds shipped in inter-State commerce. In general, the laws require that the lables attached to the containers of agricultural seeds show the percentage of pure seed, percentage of weed seed, percentage of other crop seed, percentage of inert matter, percentage of germination, percentage of hard seed, if any, the date of germination test, the name and address of the shipper, seller or person who labels the seed and the kind of seed treatment used. The label also is required to show the names and number of seeds of noxious weeds recognized by laws of the State into which the seed is being sold or into which the seed is shipped. Minimum germination levels are not applied except in the case of vegetable seeds sold in small packets. In this case, the extent of detailed labelling is not required, but the seed must have met certain minimum requirements.

17.35. The Act is enforced by having a few carefully selected seed inspectors drawing samples in each State. The samples are sent to the seed testing laboratory of the State to verify that the information carried on the label is correct. In case of samples from seed lots that have travelled in inter-State commerce, the State inspectors send the information and the sample pertaining to the apparent violation to the appropriate area laboratory of the Department of Agriculture for investigation. Through this method, it is not necessary to have a separate force of Federal seed inspectors. Inspectors involved in sampling seeds are often also responsible for sampling fertilizers, pesticides and other commodities sold to farmers in which some kind of State or Federal quality control is needed.

17.36. It is possible for the seed inspector to stop the sale of seeds until they are correctly labelled or disposed of in compliance with the law. Seizures and court proceedings may be used in more serious violations.

17.37. One strong aspect of the enforcement programme relates to the publication of results and action taken on samples tested. In addition, all of the States and the Federal Government publish various kinds of educational bulletins, question and answer sheets and posters to help both the seed trade and the consumers know what is expected.

17.38. The quality of seed being sold has improved greatly from the early periods of Seed Law enforcement. Of the 15,000 samples evaluated by the Department of Agriculture in the early 1900's 20 per cent were found to be adulterated with or containing other less desirable kinds of seeds or noxious weed seeds.

Seed Certification

17.39. Seed certification made a start in the U.S.A. at about 1900. At that time, the plant breeders with the various research programmes in the agricultural universities were developing a few improved varieties. They would often provide some of this seed to farmers who would grow it and provide them with some appraisal regarding the performance of the variety. However, it was found that this procedure was not efficient, that the seed lost its identity with these farmers and was soon mixed with other varieties in the area. To help overcome this problem, the plant breeders and the agronomists with the universities started inspecting some of the increase fields that the farmers had, so that they could confidently point to these individuals as having pure seed of the variety indicated. They often would publish lists of such farmers/growers.

17.40. Out of this beginning, grew a systematic voluntary system of seed certification. The programme is developed on a State by State basis, so that no one pattern is used throughout the country for forming a seed certification agency. The three types of organizations currently operating include—

(a) The University which provides the staff to carry out the seed certification work ;

(b) The Department of Agriculture is responsible for seed certification (the Department of Agriculture in the United States is not involved in any way in the production of certified seed) ; and

(c) The most common method, however, is through Crop Improvement Associations which are associations of farmers, seed growers, seed producers etc.

17.41. The Crop Improvement Associations, in many cases, were formed with the purpose of helping to improve the agriculture in the States in whatever way seemed appropriate. As the seed certification programmes developed, the Crop Improvement Associations became the logical groups to assume this responsibility because in most cases, the universities did not want to involve their technical staff in this particular activity except in an advisory capacity.

17.42. The Crop Improvement Associations have each an elected Board of Directors composed largely of seedsmen. But, in addition, will include one or more university officials and often include the Seed Control Officer and the Seed Certification Officer. The Board of Directors is responsible for setting the general policies for seed certification and evolving the standards that are being used. They are responsible for hiring the staff and may become involved in dealing with difficult rejection problems. The members of the Board although elected are usually on a rotating basis, so that no one person serves longer than three or four years at a time.

17.43. In 1919, a few representatives from certifying organizations in the U.S.A. and Canada met and formed the International Crop Improvement Association which has been instrumental in helping to achieve the uniform seed certification standards in North America.

17.44. Because of the way in which the seed certification agencies were formed initially, they catered to the certification of publicly developed varieties and hybrids. However, this is rapidly changing. Many private organizations are showing more interest in having their materials certified. Similarly, the certifying agencies are more inclined to accept privately developed materials in their programmes. The new emphasis on seed certification centres around the certification for genetic purity. Physical purity and germination standards are also included in the standards. Although considerable feeling exists that this should be a responsibility of the seedsmen supplying the seed the trend is toward the certification for genetic purity as is in the case of O.E.C.D. programme.

17.45. Eligibility for certification has been evaluated by a special committee working under the Board of Directors of the Crop Improvement Association or as a part of the agricultural university.

17.46. More recently a National Alfalfa Review Board was established for evaluating the privately developed alfalfa varieties and advising the individual seed certifying agencies regarding the desirability of taking particular varieties for certification. Currently, other national review boards of a similar nature are being established for evaluating the privately developed varieties and hybrids. Although the decisions by these review boards are not binding upon the State certifying agencies, their functions can be very useful to both the seedsmen interested in having a particular variety certified and the certifying agencies. The review boards help to simplify the process of getting approval on privately developed varieties which may enter the certification programme.

17.47. The seed certification agencies usually operate with a relatively small and very competent staff on a full time basis. This staff is supplemented by the addition of part-time help for approximately two months during the peak of the inspection season. The part-time help utilized includes school teachers—both agricultural and non-agricultural teachers—extension agents and university level students. Training programmes are held for the part-time inspection staff and they work with or under the very close personal supervision of experienced permanent staff members. The certifying agency will often own two or three vehicles, but the majority of the transportation will be provided by vehicles owned by the inspection staff. The certification agency will reimburse the person for the distance travelled on inspection work. The permanent staff will be involved in sampling of processed seeds from seed lots that have passed field inspection for checking the germination and issuing tags and seals. In some cases, the tags and seals are actually attached by the certifying agency staff, but in the majority of cases, the seedsman himself is responsible for assuring that this is done properly.

17.48. The certifying agencies often get involved in other kinds of activities such as—

(a) providing supplies that seedsmen need such as sample bags, regular size seed bags and analysis tags ;

(b) holding conferences and field days for helping to educate the seedsmen ; and

(c) preparing exhibits, brochures, posters, magazine advertising material and news releases which are directed at the buying public so that they are acquainted with the latest varieties available and the sources of certified seeds.

Seed Testing

17.49. Seed testing was started in the U.S.A. in the late 1800's so that all States except three had a seed testing laboratory each by 1940. The three States that did not have laboratories arranged with neighbouring States for samples to be tested in their laboratories. In addition to the official laboratories established by the Federal or State Governments, commercial laboratories have also come into being where samples may be tested for a fee as a service to farmers and seedsmen. Most State laboratories also charge a fee for samples being tested. Many of the seed certification agencies have developed their own laboratories for testing at least a portion of the seeds being certified.

17.50. The need to achieve uniformity in testing resulted in the formation of the Association of Official Seed Analysts. This Association, the Society of Commercial Seed Technologists and the International Seed Testing Association have all contributed to the better understanding of seed testing procedures and techniques. The seed analysts' and seed technologists' groups provide suggestions to the Federal Government as it prepares its rules and regulations in regard to seed testing procedures. Because of the developments in seed testing, the official rules accepted by the Federal Government have been revised approximately every five years to incorporate needed changes.

17.51. Most of the research in seed testing procedures has been carried out by the Federal laboratory at Beltsville or one of the four branch laboratories in the country. A few of the State laboratories, especially where they have been related in some way to a university, have also done some research.

17.52. Many of the people working in laboratories are quite senior with reference to experience. The leaders in all the laboratories visited, had from ten to twenty-five years' experience in seed testing.

17.53. Considerable work has been done to assist in achieving uniform results. The development of photographs of normal and abnormal seedlings, keys for identifying weed seeds, seed herbaria, training sessions and workshops are all contributing to increase uniformity within the country. Because of the cost of skilled technicians, all laboratories are utilizing labour-saving methods in every way possible.

17.54. In addition to the official and commercial laboratories, many private companies also operate laboratories for their own purposes. These laboratories too are highly efficient and are operated by well-qualified personnel. The Association of Official Seed Analysts has a programme of seed analysts so that the leaders in the field may pass this test and be identified as "registered seed analysts". Most official, commercial and private seed laboratories are headed by at least one registered seed analyst.

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CHAPTER-18

JAPAN

18.1. The most important crop in Japan is rice. The history of seed production, certification and distribution corresponds mainly to the history of rice breeding work which dates back to 1893 when the National Central Agricultural Experiment Station was established. The National Experiment Station has 5 sub-stations located at different regions. In addition, each of the 36 prefectures in the country has an experiment station of its own. The production, quality control and distribution of rice seeds are carefully supervised by the Government—both national and prefectural. The work of seed production is mainly taken up by producers' co-operatives in seed farm areas and prefectures. Until 1962, certified seed farms were located in each county or city and they produced and distributed certified seed to nearby areas. The size and location of such seed farms were not very suitable for the production of superior seed. In 1962, the Ministry of Agriculture and Forestry reorganized the seed production system in all the prefectures. Under this system:—

(a) All certified seed farms are concentrated in one area suitable for seed production crop by crop in each prefecture. The prefectural Government designates this area as a seed farm area for the crop.

(b) A Co-operative Seed Association is established in each prefecture which draws up a plan for seed production and distribution under the guidance of the prefectural Government. The Co-operative Seed Association is a federation of seed producers' agricultural co-operatives in the prefecture, agricultural co-operatives in the seed farm areas, seed renewal co-operatives and other organizations related to the system.

(c) A Seed Association should designate certified seed producers in the seed farm area and enter into contract with them. Government supports the distribution system by subsidy and regulates the cost of seed, since rice is one of the staple food of Japan.

18.2. The selection of varieties for each prefecture is done by the experiment station in the prefecture. It is the responsibility of the prefecture to maintain breeder seed farm and foundation seed farm and provide adequate foundation seed to the certified seed growers of the Seed Association.

18.3. As regards the control of quality of seeds, the Main Crop Seed Law, 1952 (amended in 1953), governs the same. The Law applies, as the term implies, to the main crops which are rice, barley, naked barley, wheat and soybeans. Unlike the Seed Laws of other countries which are mainly for regulating the quality of seeds entering trade, the Main Crops Seed Law of Japan provides for both the regulation of quality as well as arrangements for seed production and distribution. The purpose of the Seed Law is "to carry on farm tests and other measures for the seed production in order to expedite production and distribution of the superior quality seeds of main crops".

18.4. The term "farm test" means tests made by prefectures for "conditions of earing, regularity of earing and ripening of the main crops, standing on the seed production farms". The term "product tests" is defined by prefectures as the tests for germination, mixture of inferior seeds and impurities of the main crop either grown on the main seed production farm or from elsewhere. The term "farm test" corresponds to the term "certification by field inspection" as generally understood in India, and the term "product test" refers to the testing of seeds in the Seed Testing Laboratories. Every person who engages in seed production under the programme is designated as a seed grower and his crop must be subjected to "farm tests" as well as "product tests" and must receive certificates in this regard. The testing standards and the methods are determined by the prefectural Government with the approval of the Minister for Agriculture and Forestry. The Law provides that the prefecture shall cause a technical official in charge to make the test. It was understood that the inspected farms are certified by the employees of the prefectural Government but the final certification rests with the technical officers of the National Government. The tests are compulsory as seed which is not tested, is not allowed to be sold.

18.5. In addition to testing of seeds, maintaining breeder seed and experiment station the prefecture is responsible for the establishment of foundation seed farms for the main crops and for the production of stock seed for further multiplication of foundation seed. The National Government provides the subsidy to the prefectures within the limit of the annual budget as under—

(a) a part of the expenses for the farm and product tests made by the prefecture;

(b) for office work connected with giving recommendations, advice or direction necessary for the production of superior seeds and dissemination among the towns and villages; and

(c) for production of breeder and foundation seeds.

18.6. There are 8 foundation seed farms for potatoes which are directly managed by the Ministry. From this foundation stock, further multiplication is taken up at prefectural foundation farms. The seeds so multiplied are further increased through seed co-operatives organized by farmers. The seed plots and crops are inspected as provided by the Plant Disinfection Law. Unless the seed conforms to certain standards, it is not passed as seed. About 80 per cent of the final multiplication is in the hands of the agricultural co-operatives. The remaining 20 per cent is in the hands of the private dealers. As the seed production is subsidized at various levels the final seed price is only 10 per cent higher than the price of potato for consumption.

18.7. The quality of seed potatoes depends upon whether or not they have physiological vitality and health and free from virus diseases or ring-rot latent in tubers. Suitable regions for the use of seed potatoes according to areas of production are as follows:—

(a) Seed potatoes produced in the cold and the high plateau regions are suitable for the spring crop in all regions.

(b) Seed potatoes produced in the warm regions or in the cool regions by the spring crop are mostly used for the fall crop in the warm region. The variety must be especially of short dormancy.

(c) Seed potatoes produced by the fall crop in the warm region are suitable for the spring crop in the cold and high plateau region where the time of planting is late.

18.8 In 1947, seven National foundation seed farms were established, and in 1960 one more such farm was added. These foundation seed farms were established to completely control virus diseases and ring-rot latent in seed potatoes, by applying advanced scientific techniques. At these farms virus infected plants are detected by individual inspection in fields, serological test and inoculation test in laboratory. Ring-rot tubers are detected by microscopic examinations by Gram's stain and ultra violet test. Thus quite disease-free seed potatoes are planted in fields. In field, disease-infected hills are inspected for rogues many times during the entire period of growth and any hill which may be a primary source of disease of infection is removed. The foundation seed potatoes produced in this manner are sent to the registered seed farms which are located in all prefectures and operated by prefectural governments. The multiplication is done under strict inspection. The produce from these farms are then sent to certified seed farms which are managed by individual seed potato growers. Since strict inspections are carried out in both the registered seed farms and the certified seed farms according to the Plant Quarantine Law, all commercial seed potatoes are guaranteed for quality by the Government.

18.9. The foundation seed farms have a target of annual distribution of 20,000 quintals as compared with the total seed production of 1 million quintals. Appendix XIV indicates the seed production system in Japan.

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Marketing of Seed Potatoes

18.10. About 80 per cent of the farmers in Japan are growing potatoes though the total area under potatoes is limited. Each farmer grows a little and it is not worth his while to handle the marketing. Only about 18 per cent of the total potato production is for the market and the rest is being used for consumption. The National Marketing Federation of Agricultural Co-operatives handles most of the seed potatoes grown in the country. About 3.6 million packs of 20 kgs. each of seed potatoes enter into the seed market. The seed growers sell the seeds to the Agricultural Marketing Co-operatives who are members of the federation. There is a Potato Price Decision Committee which advises the President of the National federation on potato prices. In practice, the advice rendered by this Committee is usually accepted, and hence all price decisions may be said to be taken by this committee which consists of 5 members representing seed producers, seven members representing consumers and 3 members from the university. The seed production is all reserved for purchase by specific agencies and no sooner than the seed is produced it is distributed. The storage is being done by the individual farmers and not by the federation. Shortages and surpluses in production do occur and the production plans aim at producing 10 per cent more than the reserved quantity. This extra production is stored in warehouses, and storage costs were estimated at 36 Yen for a pack of 20 kgs. for two months.

18.11. Inspections for quality are done at the farm and in addition the quantity in each pack is also checked. Samples are drawn from one in 50 packs and tested to see whether the potatoes are uniform in weight and if there are any admixtures. These tests are carried out by the Ministry of Food. The potatoes are brought by the farmers to the processing centres or co-operative selection spots. Here, the persons experienced in selection, select the potatoes visually in the following grades :

L.	Large	..	120 to 190 grams
M.	Medium	..	60 to 120 grams.
S.	Small	..	40 to 60 grams.

18.12. Potatoes less than 40 grams or over 190 grams are rejected. Machinery for harvesting, grading, packing etc., are tried.

Vegetable Seeds

18.13. The system pertaining to vegetable seeds is quite different from that pertaining to main crops, and is similar to the system obtaining in other western countries. The vegetable seeds are produced and distributed on a commercial basis and intervention of the Government is very little. Some breeding work is done by the National Experiment Station, but most of the selection is in the hands of private firms. There are about 200 growers of vegetable seeds among whom 50 have nation-wide operations. Thirty of these have their own research and development farms and twenty have export trade. There is a Japanese Seed Trade Association which facilitates communication amongst the seed producers. The Agricultural Seeds and Seedlings Law of 1947 governs the transactions in vegetable seeds. The term "Seeds and Seedlings" covered by the Law includes :

55	species of vegetables
14	species of fruit trees
160	species of flowering plants
229	Total

18.14. "Seeds and Seedlings Tradesman" refers to any person engaged in the business of dealing with guaranteed seeds and seedlings. The term "Guaranteed seeds and seedlings" means such seeds and seedlings as are specifically designated by the Minister for Agriculture and Forestry to have a guaranteed card attached.

18.15. A Seeds and Seedling Tradesman has to submit a report to the Mayor or other Head of the city, town or village in which his business place is situated in respect of each of the business places the following particulars :

(a) Name of title and address.

(b) Name of business place.

(c) Names of guaranteed seeds and seedlings handled at the business place concerned.

(d) Place where the book showing transaction of guaranteed seed and seedlings as prescribed in preceding para is kept.

(e) Other items provided by an ordinance.

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18.16. Every dealer is required to indicate on seeds sold by him, the kind, variety, germination, purity etc. There are about 28 kinds of vegetables coming under this category. The Law provides for registration of varieties. For this purpose, an Advisory Committee of Counsellors of Agriculture has been constituted. There are 60 counsellors but these form into several groups. For seeds and seedlings department, there are about 20 counsellors. There are representatives of Government, prefectures and the university and 3 representatives from the private trade one representing fruit seeds, one flower seeds, and one vegetable seeds. The procedure of registration is voluntary. A person who gets his variety registered has the right of sole distributorship (breeders' rights for 3 to 10 years depending on the species). The variety is tested by one of the connsellors specified by the committee at two or three centres including the breeder's own farms. At least one year's testing (one normal season's testing) is required. The variety should be new and also should have commercial merits or superiority in production. Each year 10 to 15 varieties are approved. Twenty to thirty varieties are rejected. Vegetable varieties are tested at 4 to 6 locations. The testing of fruit varieties is done by observation of fruits. The report of the Advisory Committee is generally accepted by the Ministry.

Long Term Seed Storage

18.17. A special feature of the Japanese seed development programme is the arrangement for supply of initial breeder stock seed for systematic research. This consists of a regular study of collecting, evaluating the seed for various botanical and agricultural values and cataloguing the information of these genetic stocks. This information includes not only biological viewpoints but also physical, economic and social viewpoints. Experimental studies on the new procedures of observation such as growth analysis of varieties, methods of describing characteristics and others have been carried out. Studies have been also carried out on seed raising procedures, significance of practical purity of variety, genetic variability within variety, competition effects on the phenotypic variation, the genoecological studies on rice varieties and similar other problems. The longevity of germplasms and problems connected therewith have also been studied. The studies were primarily centred on rice, till 1965, but other crops are being taken up. The results of studies have been put to practical use by establishing a facility for long-term seed storage of these genetic stocks. The facility is basic to the maintenance of pure stock helping both research in plant breeding and seed multiplication, a brief indication of which is given in Appendix XV.

18.18. The long-term seed storage house which is called the "Germplasm Bank" for genetic stocks of economic plants was completed in March, 1966 and the seed storage services started at the centre of germplasms storage and exchange in Japan. The seeds stored in this house are limited to germ plasms for plant breeders' use. It concerns not only agricultural crop plants but also horticultural, industrial, and forage crop plants. The size of the seed storage house is 336 sq. metres in all, with 53 sq. metres in a room for long-term storage at —1°C with less than 30 per cent relative humidity, and with 6 sq. metres in a room for extremely long storage at —10°C and less than 30 per cent relative humidity. The cost of the building and air-conditioning facilities was estimated at Rs 1 lakh or 14,000 dollars. The seed storage house is provided with a seed cleaning and packaging room with most refined instruments of cleaning and packaging. It is provided with facilities for germination testing.

Private Vegetable Seed Organizations

18.19. The Sakata Seed Company was started by a nursery man dealing mostly in flower seeds, particularly for exports. During 1923-24, the firm acquired a reputation for its seeds of double flowering petunias, enjoying a world monopoly in this for 10 years after the war. The firm specialized in introducing new varieties. Prior to World War II, 80 per cent of the production was exported, but at present 15 per cent of the production is exported and the rest is sold in the domestic market. The firm has two branches in Japan. There are no overseas branches. The seed is sold at wholesale to seedsmen and the farmers' co-operatives. 80 per cent by quantity and 70 per cent by value goes as sales at the wholesale level and the rest is sold in retail and by mail order. The firm has six farms and has 350 employees. In addition temporary employees are taken during the busy season. Among the farms, two are specialized in flowers, one in vegetables and three in research. Isolation problems have to be faced in respect of seed production. The firm does not apply for approval of varieties as most of the new varieties are hybrids and breeders' rights were restricted for 6 years only. A number of new varieties are introduced each year (approximately 100). Of these the firm's share is about ten. There are many outstanding varieties particularly in cabbage, cucumber and tomato. The hybrid Chinese cabbage seed is said to do very well in tropical countries. The production is organized through interested farmers. Over 10,000 farmers are contracted by the Company. There is no system of certification but truthful labelling is provided. The firm's processing plant was visited by the Team. It was seen that the firm is adopting some old methods using considerable labour but also some modern machinery especially in respect of packaging. There was a rotary cleaner with three vessels and a vacuum suction device. There was also a sortex pneumatic separator. Hand cleaning of seeds is being adopted in certain cases. Six persons were employed in this operation and the average quantity per person per day worked out to 30 lbs of brassica seed. Paper bags with polythene laminations and nylon net worn over bags were being used.

18.20. There is a growing tendency towards the adoption of modern seed processing techniques. New processing plants are being erected which include indented cylinder separators, scalpers and drying equipment which are imported when necessary. Seed packaging has made considerable advance and attractive containers are being used which undoubtedly help in the export trade. Seed testing is also done on modern lines and the Team had the opportunity to visit one of the seed testing stations where about 3,000 samples a year were being tested.

CHAPTER—19

THE PHILIPPINES

19.1. The main crop in the Philippines is paddy. Besides its own research institutions, the International Rice Research Institute is also located at Los Banos near Manila in the Philippines. The Team visited the Philippines Bureau of Plant and Industry, the seed testing laboratory under the Bureau of Plant and Industry, the International Rice Research Institute, the Agricultural Credit Administration, ESSO and the Seed Corporation of the Philippines (the latter two are private organizations). Unlike the other countries visited, there is no Seed Law in the Philippines. The Secretary (Agriculture and Natural Resources) has, however, constituted a Seed Board to evaluate the performance of different varieties and approve the same for commercial adoption by farmers. Trials for a least three seasons or three years, as the case may be, are considered necessary. New varieties are not introduced without undertaking regional testing for resistance to pests and diseases though the seed increase is simultaneously started while regional testing is being done. Varieties introduced from foreign countries are planted in observational nursery plots, promising varieties are later included in preliminary tests, then in general and regional tests. It was recognized that there was a time-lag between the release of new varieties and extensive availability of seed thereof. It was proposed to overcome this time-lag by undertaking multiplication concurrently with regional testing.

19.2. Breeder seed is produced by the originating agency i.e. either the Bureau of Plant Indsustry or the College of Agriculture or the International Rice Research Institute. The Bureau of Plant Industry is primarily responsible for the production of foundation seed of rice though the College of Agriculture and the International Rice Research Institute also help. Registered seeds are produced by the Bureau of Plant Industry and selected farmers, while certified seeds are produced by farmer co-operatives and private seed companies. The seeds produced in a given province are procured and distributed in the same province so that there will be no excess of stock of seeds when the planting season is over. The Government sells the seeds at the price they are purchased from the seed producers. The prices of registered or certified seeds are much higher than the prices of commercial grains. The Government is, however, attempting to reduce the amount of seed purchased by it.

19.3. Seed certification is still new in the Philippines. At present, only rice, maize and soybeans are in the certification programme. The Production Division of the Bureau of Plant Industry is reponsible for seed certification.

19.4. There are five Government seed testing, laboratories in the country. Approximately 1,488 samples were tested in all the laboratories. It was stated that it took 7 to 14 days to complete the test depending on vigour index and moisture content. Tetrazolium test is applied for shorter procedure though this is still in an experimental stage. Some seed farms also maintain seed testing units.

19.5. The International Rice Research Institute at Los Banos near Manila, the Philipines, was visited by the Team. Besides its extensive research programme, the Team was impressed with the research on quality of rice and also by the library facilities which had been built up and which are available to research workers in various countries. The Institute also organizes training programmes for students from different countries. These training programmes are practically oriented and are intended to impart on the extension workers and others the latest advances in rice cultivation. The chart given in the Annexure indicates the activities of IRRI in relation to the national programmes in increasing rice yields.

19.6. The Team had the opportunity to visit the main office of the ESSO Standard Fertilizers and the Agricultural Chemicals Co. Inc. The Company is developing an aggressive sales programme utilizing modern sales aids through agro-service centres. Considerable emphasis is laid on the training of agronomists and salesmen who have to carry the new techniques and inputs to the farmers.

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CHAPTER—20

INTERNATIONAL ORGANIZATIONS

20.1. The developing international character of seed trade is evident by the various organizations that are devoting themselves to various aspects of seed industry in different countries. Besides the Food and Agriculture Organization of the United Nations, there are among others the following international organizations in the field :—

(i) The International Seed Testing Association which devotes itself to securing uniform and accurate results in seed testing in different countries in the field.

(ii) The Organization for Economic Co-operation and Development which has developed certification systems acceptable to participant countries.

(iii) The International Crop Improvement Association which is an organization of seed certification agencies in the United States and Canada.

(iv) The International Seed Trade Federation which represents the seed trade in various countries.

(v) International Association of Breeders for the Protection of Plant Varieties.

20.2. In this section, we have described in brief the functions and activities of the International Seed Testing Association, the Organization for Economic Co-operation and Development and the International Crop Improvement Association with whose members the Team had the opportunity to discuss various aspects of seed industry.

INTERNATIONAL SEED TESTING ASSOCIATION

20.3. Since the first seed testing station was founded in 1869, seed testing stations have been setup in almost every country in Europe, the U.S.A., Canada, Australia and in several countries of Asia and Africa. The object of seed testing is to protect the farmers against the hazards arising from sowing of inferior seed. Seed testing result figures are now commonly accepted by buyers and sellers of seeds as indices of quality. In view of the international nature of seed trade, there is need for uniformity in testing methods in all countries. The first step towards international co-operation in the field of seed testing was taken at the First International Seed Testing Congress held in Hamburg in 1906. At the Third International Seed Testing Congress in Copenhagen in 1921, the European Seed Testing Association was founded. At the Fourth Seed Testing Congress in Cambridge (England) in 1924, it was decided to extend the activities of the Association to all countries and the Association was reconstituted under its present name—the International Seed Testing Association. The International Seed Testing Association is a Government recognized Association and more than 50 member countries represent all parts of the world. According to Article 4 of the Constitution, the members shall be persons who are engaged in the science or practice of seed testing or in technical control of these activities and who, in addition, are nominated by their Governments. Normally, senior officers of official seed testing stations are nominated for membership. India is a member of the International Seed Testing Association. Accredited stations are entitled to issue test results on special forms (orange, green and blue) by authority of ISTA. These special certificates and reports are now widely used in international seed trade and greatly facilitate free and unhampered movement of seed from one country to another.

20.4. In order to ensure the achievement of its primary objective, namely, to ensure accurate and uniform methods in testing and evaluating seeds, the ISTA is concerned with research, both applied research to develop seed technology and seed testing, fundamental research to better understanding of the physiological, taxonomical, phytopathological and other problems and education stressing the importance of the use of better seeds for the increase of agricultural production. To ensure uniformity, the ISTA has specified the rules for seed testing and these rules are widely accepted and are revised from time to time and are available in many languages. The rules are being used even by countries who are not members of the International Seed Testing Association. From time to time workshops are arranged to attain uniformity in interpretation of the rules and these workshops provide opportunities to discuss the desirability of further changes. In recent years, the ISTA has paid increasing attention to standardization of equipment. The International Seed Testing Association has a system of international and regional referee testing through which the participating stations can appreciate their shortcomings. All stations that want to issue ISTA certificates or reports are obliged to participate in the referee testing. The results of research are published in the proceedings of the ISTA of which four issues appear annually.

20.5. On behalf of the international seed trade, the ISTA distributes standardized international certificates and the reports of which six are available at the moment.

THE ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

20.6. The Organization for Economic Co-operation and Development is an international organization concerning itself with seed. This was set up under a Convention signed in Paris on the 14th December, 1960, by the member-countries of the Organization for European Economic Co-operation and by Canada and the United States. This Convention provides that the O.E.C.D. shall promote policies designed:

(a) to achieve the highest sustainable economic growth and employment and a rising standard of living in member-countries, while maintaining financial stability, and thus to contribute to the world economy ;

(b) to contribute to sound economic expansion in member as well as non-member countries in the process of economic development ; and

(c) to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

20.7. The members of the O.E.C.D. are Austria, Belgium, Canada, Denmark, France, the Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Japan, Luxemburg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

20.8. India has not become a member of the O.E.C.D. so far. The O.E.C.D. has developed a scheme for ensuring certification of herbage seed on a uniform basis. The scheme authorizes the use of labels and certificates for seeds reproduced and processed in international trade according to certain agreed principles.

20.9. The scheme is open on a voluntary basis to all member-countries of the O.E.C.D. and to those non-member countries in the O.E.C.D. which are members of the FAO. If a country participates in the O.E.C.D. Herbage Seed Scheme it is obliged to ensure that the rules of this scheme are strictly observed.

20.10. The scheme is based on the following main principles :—

(a) It includes only those cultivars which are officially recognized as distinct and having some value. The names of these cultivars are published in official lists ;

(b) All the certified seed produced must be related directly through one or more generations to authentic basic seed of the cultivar. The main factor determining the standard of certified seed is varietal purity of basic seed and for this reason special tests for basic seed are prescribed. Satisfactory conditions for the production and processing of certified seed must be ensured and verified by field inspection and post-control tests ; and

(c) The main object of post-control tests is to ascertain that the scheme is operating satisfactorily. In particular, these tests are intended to determine that the characters of cultivars have remained unchanged in the process of multiplication, and to enable the varietal purity of individual seed lots to be verified.

20.11. The success of the scheme depends upon the maintenance of a very close co-operation between the breeder and the designated authorities in each participating country particularly when seed multiplication takes place outside the country of origin of a cultivar and the designated authority has permitted such a commercial multiplication, the breeder should be consulted and close contact maintained between the designated authorities in the countries concerned.

20.12. It is intended that "O.E.C.D. Certified Seed" of first and successive generations (blue and red labels respectively) be used for fodder production only and not for further multiplication for trade purposes except by special arrangement between the breeder and the seed producer.

20.13. The definitions of the terms used for the purposes of the OECD Herbage Seed Scheme are given in Appendix XVII. Specimen certificates and analysis results are also given in Appendix XVIII. Specifications for the OECD label are given in Appendix XIX.

20.14. The International Crop Improvement Association is another organization working on international basis in respect of seeds. Forty-two States in the United States and Canada are members of the Association. It is an organization of seed certifying agencies. It was set up in 1919 with the following purposes :—

(a) To assist its members in promoting the production, identification, distribution of certified seeds and other propagating materials of superior crop varieties ;

(b) To establish minimum standards of seed production, storage and handling ;

(c) To assist in standardization of certification requirements and procedures to the end that all certified seed will be as good or better than an accepted, minimum standard of quality.

(d) To inform the public as to the value of certified seed and encourage its wide-scale use through approved educational media ;

(e) To develop co-operation with all individuals, groups and organizations directly or indirectly interested in the improvement of crops.

20.15. The Association has done valuable work in developing standards for certification for various crops, which are being modified from time to time. The Indian Seed Team had an opportunity to attend the Annual Meeting of the International Crop Improvement Association and was considerably impressed by the discussions at the Conference. Practical problems in seed certification were fully thrashed out by its members and suitable modifications made.

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ACKNOWLEDGEMENT

In the present Study, the Team received valuable assistance from many quarters. The Team had the opportunity to study in detail various aspects of seed industry in Sweden, the Netherlands, the United Kingdom, the United States of America, Japan and the Philippines, thanks to the well thoughtout and carefully prepared itinerary and the arrangements made by Mr. Johnson Douglas and Professor A.S. Carter of the Rockefeller Foundation. To the many institutions, organizations and individuals in the various countries visited who had given facilities for our visiting them and holding discussions we express our thanks. The Team had also the benefit of meeting Dr. J. George Harrar, President, Dr. Sterling Wortman, Director, Agricultural Sciences, and Dr. Ralph W. Cummings, Associate Director, Agricultural Sciences, of the Rockefeller Foundation in New York. We are also grateful to Dr. A.F. Schoorel who both in his capacity as Director, Government Seed Testing Station, Wageningen, and as the Hony. Secretary and Treasurer of the International Seed Testing Association, assisted us with many useful discussions. Discussions with them were of special value. Our special thanks are due to Shri B. Sivaraman, Secretary to the Government of India, Ministry of Agriculture, for the opportunity given to the Team for a full and frank discussion on different aspects of seed industry. The Ministry of Food and Agriculture and the National Seeds Corporation helped us in a liberal measure with their personnel and facilities and by providing voluminous and varied information. The various governments in the States we visited had made excellent arrangements for a survey of the work actually being done in the field. The Development Commissioners, the Agricultural Secretaries of the State Governments, the Directors of Agriculture, Directors of research institutes and the staff of agricultural universities gave a good part of their time to discuss with the Team various issues as they impinged on various issues. The Team is also thankful to the farmers, seedgrowers, co-operators and representatives of seed processing industry all of whom contributed materially to the work of the Team. Special mention must be made of the Indian Council of Agricultural Research, the Indian Agricultural Research Institute, the agricultural universities of the Punjab, Mysore, U.P. and Andhra Pradesh with whom the Team had discussions. The Team had also the privilege of discussing the more important questions of public policy with the Union Minister of Food and Agriculture, the Chief Minister of Maharashtra, the Agricultural Ministers of Jammu & Kashmir, Mysore, Andhra Pradesh and Madras. The Team is grateful to them for the same.

But for the co-operation of the various representatives of seed industry and in particular the All-India Vegetable Seed Growers, Merchants and Nurserymen's Association and the India Crop Improvement and Certified Seed Producers' Association, the Report would not have been as complete as it has turned out to be. We are indebted to these Institutions and to their office-bearers, and various seed growers for assistance rendered and for the information furnished by them.

The staff of the National Seeds Corporation who had provided the secretarial assistance for the Team had laboured hard in the preparation of the Report and we would like to convey our thanks.

In conclusion we would like to place on record our appreciation of the contributions made by the Experts of the Rockefeller Foundation, the Ford Foundation, the U.S.A.I.D., F.A.O. and the World Bank. Special mention has to be made of Dr. G.B. Baird and other staff members of the Rockefeller Foundation for providing us with a wealth of information derived not only from their experience in the developed and various developing countries but also based on the direct experience of the seed development work in the country. We also benefited greatly by the expert advice provided by the foreign consultants, i.e., (1) Prof. A.S. Carter ; (2) Dr. Walter Scott ; and (3) Mr. Clare Porter whose visit was arranged by the Rockefeller Foundation. Our thanks are due to these Experts who have given their evaluation of the situation in the country and given many concrete proposals which were of great assistance to the Team though the Team could not agree with them in all respects.

Our thanks are especially due to Mr. Johnson E. Douglas who rendered invaluable assistance to the Team both in their itinerary abroad and tour within the country and in all stages of discussions of the Report. We would like to place on record our deep appreciation of the devoted work done by Shri J. Veeraraghavan in going through the large volume of literature and in the preparation of the Report.

I.J. NAIDU	.. Leader
H.R. ARAKERI	.. Member
R.L. PALIWAL	.. Member
ANAND SAWANT	.. Member
B.R. BARWALE	.. Member
C.G. RAMANATHAN	.. Member
J. VEERARAGHAVAN	.. Member-Secretary

New Delhi,

Dated : 14th June, 1968.

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PART IV

सत्यमेव जयते

LIST OF INSTITUTIONS VISITED AND PERSONS MET

Name of Institutions	*Name of Persons Met*
THE UNITED KINGDOM	
1. The National Institute of Agricultural Botany Huntingdon Road, Cambridge	(1) Dr. F. R. HORNE, C. B. E., M.A., Director
	(2) Dr. P. S. WELLINGTON, D.S.C., B.Sc., Assistant Director
	(3) Mr. C. S. ELLIOTT, B. Sc. (Agric,), Head of Trials Branch
	(4) Mr. H. N. GREENWOOD, B. Sc. (Agric.), Head of Multiplication Branch
	(5) Mr. C. G. FINCH, C. M., B. Sc. (Hort.), Head of Seed Production Branch
	(6) Mr. A. F. KELLY, M. Sc., Head of Systematic Botany Branch
	(7) Mr. D. B. MacKAY, M. A., Chief Officer, Official Seed Testing Station
2. Representative of U.K. Government	Mr. S. R. MALES, Head of Seeds Branch, Ministry of Agriculture, U. K. Government
3. Representatives of Seed Companies—	
(a) R. W. Gunson (Seeds) Ltd., 20/21 St. Dunstan's Hill, London E.C.D.	(1) Dr. C.de FELLNER, F.N.I. A.B., Dip Agric.
(b) Hurst Gunson Cooper Taber Limited, Witham, Essex	(2) Mr. G. F. HENS., and Mr. G. BALINT
(c) Charles Sharpe Co., Ltd., Seed Growers, Sleaford, England	(3) Mr. RAYMOND COY, Director
(d) Sutton & Co. ..	(4) Mr. UNDERWOOD
THE UNITED STATES OF AMERICA	
New York— Rockefeller Foundation, 111 West 50th Street, New York 10020	(1) Dr. G. HARRAR, President
	(2) Dr. W. ILLIAM MYERS, Vice-President
	(3) Dr. R. W. CUMMINGS
	(4) Dr. S. WORTMAN
Washington— (1) Federal Seed Testing Laboratory Beltsville, Maryland, U.S.A.	(1) Mr. S. F. ROLLINS, Chief Federal Seed Acts Division, U.S.D.A.
	(2) Mr. CLYDE R. EDWARDS, Chief of Enforcement Section, Federal Seed Acts Division, U. S. D. A.
	(3) Mr. C. S. GARRISON, Forage and Range Branch, Agricultural Research Service, U.S.D.A.
(2) U. S. Agency for International Development, Washington	(1) Dr. JAMES BLUME, Head, Technical Division, N.E.S.A. Bureau, U.S.A.I.D.

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Name of Institutions	*Name of Persons met*
	(2) Dr. WILLIAM C. DAVIS, N.E.S.A. Bureau, U.S.A.I.D.
	(3) Mr. JOHN WILSON, War ON Hunger Division, State Department
	(4) Dr. DEAN BUNCHE, Director for International Programmes, Mississippi State University
(3) World Bank	(1) Mr. JAMES EVANS
	(2) Mr. GREGG VATOW
	(3) Mr. VON GONTARD
Biloxi, Mississippi— (1) Canadian Seed Growers' Association	(1) Mr. ORRIN M. CLAYTON, Ministry of Agriculture (Seed Sec.), Canada
	(2) Mr. HOWARD PARNELL, Assistant Chief (Seed sec.)
(2) State Plant Board, Arkansas	Mr. JOHN BALDWIN, Incharge of Certification
(3) American Seed Trade Association	Mr. FLOYD INGERSOLL, President, A. S. T. A. and Manager, Illinois Foundation Seeds Inc.
(4) International Crop Improvement Association	Mr. B. W. FORTENBURY, Extension Specialist in Seed Improvement, University of Kentucky, Lexington, Kentucky
Starkville, Mississippi— Mississippi State University ..	(1) Prof. JAMES C. DELOUCHE, Head of Seed Technology Laboratory, Mississippi State University
Starkville, Mississippi ..	(2) Prof. B. R. GREGG., Assistant Agronomist
	(3) Prof. A. H. (BILL) BOYD, Assistant Agronomist
	(4) Prof. HOWARD C. POTTS, Associate Agronomist
	(5) Prof. GEORGE DOUGHERTY, Assistant Agronomist
	(6) Mr. N. S. GILL, NSC Staff member on a degree programme
Columbus Mississippi— Sawan, Division of W.R. Grace and Company	(1) Mr. JOHN FORD, Sales Manager
	(2) Mr. M. C. GRAVES, Analyst
	(3) Mr. JOHN RERCHLE, Processor
Dekal Illinois— Dekal Agricultural Agen. ..	(1) Mr. THOMAS H. ROBBERTS (Jr.) President
	(2) Mr. ROGER RASMUSEN, Director, International Seed Operations
	(3) Mr. JACK NELSON, Vice-President, Poultry Division
	(4) Mr. HAROLD NOREN, Marketing Division

Name of Institution	*Names of Persons Met*
	(5) Mr. HAROLD NOLIN, Production and Distribution Division
	(6) Mr. WAYNE FOWLER, Education Division
	(7) Mr. RICHARD HOLLAND, Director of Agronomic Research
Saginaw, Michigan—	
(1) A.T. Ferrel & Co., Saginaw, Michigan ..	Mr. EDWARD KRAUSE, Export Sales Manager
(2) Sortex Company of North America Inc. Lowell, Michigan	Mr. ANTHONY D. ANDREWS, Sales Manager
(3) Michigan Beans Co.	
Indiana State—	
(1) Purdue University, Lafayette, Indiana ..	(1) Dr. E.D. SCHALL, Seed Commissioner and State Chemist of Indiana
Indiana State ..	(2) Mr. AMMIN SWOPE (Jr.), Chief Inspector
	(3) Mr. L.C. SHENBERGER, Chief Seed Analyst Incharge of Seed Testing Laboratory
	(4) Mr. JOHN GERARD, Manager, Seed Certification Service, Indiana Crop Improvement Association
(2) Asgrow Seeds Co., Inc., Oxford, Indiana ..	(1) Dr. PAOLO B. TRAMBUSTI, President, Asgrow Seed Company International Orange, U.S.A.
	(2) Mr. RICHARD AHERN, Sales Manager
	(3) Mr. LESTER SPROUL, Production Manager
(3) The Moews Company, Boswell, Indiana ..	(4) Mr. CURT SCHULZE, Assistant Production Manager Mr. ERRIT VEENSTRA, General Production Manager
(4) Pioneer Seeds Co., Tipton, Indiana ..	(1) Mr. FLOYD COLLINS, Director, Sales
	(2) Mr. WOODS, Sales Manager
(5) Mitchell Farms, Windfall, Indiana ..	(1) Mr. JUNE MITHELL, President
	(2) Mr. MERLE VORIS, Vice-President
(6) Adlers Seeds Inc. Sharpsville, Indiana ..	Mr. HOWARD ADLER, President
(7) Agricultural Alumini Seed Improvement Association, Lafayette, Indiana	Mr. L.C. MEADE, Manager
(8) Indiana Farm Bureau Co-operative Seed Division Crawfordsville, Indiana	Mr. RICHARD STALCUP, Manager
(9) Northrup King & Co. (Crawfordsville Plant), Crawfordsville, Indiana	Mr. Ed. FLANNIGAN, Manager
(10) Walter J. Harpal Seed Co. (MIGRO), Crawfordsville, Indiana. ..	Mr. WALTER J. HARPEL
Illinois—	
(1) Illinois Crop Improvement Association Urbana, Illinois	Mr. GEORGE KEITH, Manager
(2) Illinois Foundation Seeds Inc. Urbana, Illinois ..	Mr. CLARION B. HENDERSON, Breeder

Name of Institution	*Names of Persons Met*
(3) Funk Brothers Inc., Bloomingtion, Illinois..	(1) MR. D.D. WALKER, President
	(2) MR. R.J. LAIBLE, Manager, Hybrid Corn Division
	(3) MR. HAROLD GOODWIN, Manager, Farm Seed Division
	(4) MR. LEON STEELE, Vice-President, Director of Research and International Operations
	(5) MR. JOHN ESCH, Public Relations
	(6) MR. JOSEPH E. BARNES
Iowa—	
(1) Pioneer Seeds Co., Des Moines, Iowa ..	(1) MR. JAMES W. WALLACE, President
	(2) MR. WAYNE SKIDMORE, Vice-President
	(3) MR. JOHN AIRY, Vice-President
	(4) MR. NELSON URBAN, Assistant to President
	(5) MR. DALE PORTER, Legal Counsel
	(6) MR. KARL JARVIS, Incharge of Research Station
	(7) MR. BOB DAHLBERG
	(8) MR. JOHN WALLACE, Sales Promotion
	(9) MR. ROBERT WOLFE
(2) Corn States Hybrid Service Inc., 6139, Fleur Drive, Des Moines 15, Iowa	(1) MR. JOHN SPENCE
	(2) MR. HAROLD E. ATKINSON
	(3) MR. ROBERT WOLF
Nebraska —	
(1) N.C. + Hybrids Inc., Lincoln, Nebraska..	(1) MR. CLARE PORTER, Manager
	(2) MR. DEAN DOUGLAS, Production Manager
Nebraska—	
(2) University of Nebraska, Foundation Seed Organization, Nebraska	MR. RICHARD N. MILLS, Manager
(3) Nebraska Crop Improvement Association..	MR. DEAN LANCASTER, Manager
(4) Department of Agronomy, University of Nebraska	MR. WARREN R. SAHS, Incharge of Experimental Station, Operations
(5) Seed Testing Laboratory, Nebraska Department of Agriculture, Lincoln, Nebraska.	MR. ELLSWORTH CARLSON

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Name of Institution	*Names of Persons met*
CALIFORNIA—	
(1) Ferry-Morse Seed Co., Mountain View, California	(1) MR. S. EDDY, President
	(2) MR. RICHARD W. McKENNA, Vice-President
	(3) MR. WILLIAM F. FOOS, Treasurer
	(4) MR. F.C. MacDONELL, Manager, International Operations
	(5) MR. MARVIN W. PRATT, Assistant Manager, International Operations
	(6) MR. CLAYTON JOYCE, Production Manager
	(7) DR. DAVID THOMPSON, Breeder
(2) A.L. Castle Inc., 100 Mast Street, Morgan Hill, California	MR. BERNARR L. WILSON, Vice-President
(3) Waldo Rohnert Co., Hollister, California..	(1) MR. BILL CHANEY, President
	(2) MR. JOHN ATKINS, Breeder
(4) SRS Seeds, Niagra Chemical Division, FMC Corporation, Modesto, California	(1) MR. L.R. ROBINSON (Sr.), President
	(2) MR. JOHN F. KLUBER, Production Co-ordinator
	(3) MR. HANS J. FREMY, Export Sales Manager
(5) Department of Agriculture, State of California, Sacremento, California	(1) MR. RICHARD LYNG, Deputy Director
	(2) MR. HANK SCHERENBERG, Seed Inspection Specialist
	(3) MR. RODNEY COBB, Incharge, Seed Testing Laboratory
(6) California Crop Improvement Association.. University of California, Davis, California	(1) MR. MILTON MILLER, Rice Specialist
	(2) MR. BOB BALL, Inchaege of Administration
	(3) MR. JIM HARRINGTON, Incharge of Vegetable Crops
	(4) DR. BILL SIMS, Breeder
(7) Caladino Farm Seeds Incl. Willows, California	(1) DR. TOM YOUNG, Plant Manager
	(2) MR. MICHAEL RADFORD, Assistant Manager
(8) Pacific International Rice Mills	. MR. CURT STORZ
(9) Northrup King & Co., Research Department, Woodland, California	MR. D. B. GRISSOM, Research Department

Name of Institution	*Names of persons met*
JAPAN	
(1) Ministry of Agriculture and Forestry Kasumigaseki, Chiyoda ku, Tokyo	(1) Mr. MASAHIRO MATSUNOBU, Agricultural Crops Section, Agricultural Administration Bureau
	(2) Mr. SOHESI YOKOI, Horticulture Section, Horticulture Fureau.
	(3) Mr. UEMATSU, Special Production Section, Horticulture Bureau.
	(4) Mr. NAKAMURA, Seed Testing Laboratory Horticulture Burequ
(2) National Marketing Federation of Agricultural Co-operative Association, Dhtemachi, Chiyoda-ku, Tokyo	(1) Mr. CHINO, Chief of the Section
	(2) Mr. YAMANOUCHI, Chief of the Crops Section
	(3) Mr. SUSUMU OZAKI, Potato Section, Potato and Starch Division
(3) National Federation of Agricultural Purchasing Co-operatives Association, Ohtemachi, Chiyoda-ku, Tokyo	Mr. NIHEI, Technical Adviser
(4) Sakata & Co., No. 2, Kiribatake, Kanagawa-ku, Yokohama, Kanagawa Prefecture	(1) Mr. TAKEO SAKATA, President of the Co.
	(2) Mr. MASAYUKI SAKATA, Executive Managing Director
(5) National Institute of Agricultural Sciences, Nakahara, Hiratsuka City, Kanagawa Prefecture	Mr. KANICHI MPIMI, Chief of Comath Section
(6) Satake Engineering Co.	Mr. KUMMATOU FUM GOOSI Subsection Chief Export Section, Export Division, No. 7-24-Chome Soto-kanda Chiyoda-ku, Tokyo
(7) Overseas Technical Co-operation Agency, Economic Co-operation General Building, No. 42, Honura-cho, Ichigoya, Shinjuku-ku, Tokyo	Mr. MICHIYORI AOKI, Training Co-ordinator
THE PHILIPPINES	
(1) Bureau of Plant Industry	(1) Mr. VINCENTE B. ARANCILLO, Assistant Director of Operations
	(2) Mr. EPITACIO A. LANUZA, Assistant Director for Research
	(3) Mr. ALFREDO HERNAEZ, Chief Production Division
	(4) Mr. BENITO C. GONZALES, Supervising Agricultural Engineer
	(5) Mr. HONORATO LUMANG, Senior Research Chemist and Acting Chief, Laboratory Services Division
	(6) Mr. BURT RAY, B.P.I., Manila (R.F.)
	(7) Mr. ANTERO T. JOCSON

	Name of Institutions	*Name of Persons Met*
	(2) Agricultural Credit Administration	(1) Mr. VICENTO O. VALLEY, Administrator (2) Mr. AMADO A. LANZANG, Assistant Administrator (3) Mr. PEDRO VALLADOLID, Manager, Special Operations, Department (4) Mr. ROBERT E. PORTER, Head Executive Assistant to the Administrator (5) Mr. GREGORIO RAMIREZ, Chief Special Project office
	(3) Esso Standard Fertilizer and Agriculture Chem. Co., Inc. (Phil.)	(1) Mr. P. ONSTOT, Vice-President, Marketing (2) Mr. J. G. DAVIDE, Marketing Operations Department
	(4) Seed Corporation of the Philippines 327, Quezon Blvd Ext., Q. C., P. O. Box 168, O.C.	(1) Dr. FERNANDO ORDOVEZA, General Manager (2) Mr. RAMON D. MESCALLADO, Assistant General Manager (3) Mr. PAULINO C. ALVAREZ
	(5) International Rice Research Institute	(1) Dr. R. F. CHANDLER, Director, I. R. R. I. (2) Dr. D. S. ATHWAL, Assistant Director, I. R. R. I. (3) Dr. F. BYRNES, Communication Department, I.R.R.I. (4) Mr. H. M. BEACHELL, Plant Breeder, I. R. R. I. (5) Mr. E. O. CASEM, Assistant Agricultural Engineer, I. R. R. I.
SWEDEN :		
	The Swedish Seed Association, Main Institute SVALOF (Sweden)	(1) Professor Erik Akerberg, Director (2) Mr. Gosta Olsson, Fil. Dr. Head, Division of Wheat and Oats (3) Mr. Arne Hagberg, Fil. Dr. Head, Division of Rye, Barley and Fibre Plants (4) Mr. Robert Olered, Fil. Lic., Head Division of Chemistry
	Swedish State Seed Testing Station, Soha (Sweden)	(1) Prof. Harold Esho
	Swedish State Seed Testing Station, Lund (Sweden)	(1) Dr. Guster Andersson
	Allmauna Svenska Utsadesaktiebolaget General Swedish Seed Co. SVALOF (Sweden)	(1) Mr. Gunnar Enge.
NETHERLANDS	International Agricultural Centre 1, Generoal Foulkesweg, Wageningen (Netherlands)	(1) Mr. H. Smit.
	N.A.K.G. (Inspection Service—Horticultural Seeds) Laan Copes Van Cattenburch 56, The Hague, Holland	(1) Mr. G. T. Grooters Director (2) Mr. Kinia, Assistant (3) Mr. Ms. Korteweg, Assistant
	N.A.K. (Inspection Service—Agricultural Seeds) Bosrandweg 5, Wageningen, Holland	(1) Mr. J. Van Dixhoorn, Inspector
	The Official Seed Testing Station, Binnenhaven 1, Wageningen, Holland	(1) Dr. A. F. Schoorel, Director (2) Mr. M. J. F. Koopman Deputy Director (3) Dr. J. De Tempe } Staff members (4) Dr. J. Bekendam } Staff members (5) Drs. J. E. Boeke } Staff members (6) Drs. Miss S.C. Radersma } Staff members (7) Mr. W.W.A. Oomen } Staff members

APPENDIX—I

QUESTIONNAIRE

I. Planning of Seed Production :

1. How often are new varieties introduced ?
2. What is the prescribed procedure for release of new varieties of agricultural and horticultural crops ?
3. What safeguards are used for the release of new varieties from the plant diseases aspect ?
4. What are your suggestions, if any, for reducing the time-lag in the release of new varieties ?
5. What is the procedure adopted for introduction of new varieties from foreign countries ?
6. Is there any undue time-lag between release of new varieties and extensive availability of seed of the varieties released ? If so, what methods could be adopted to cut short the time-lagt?
7. How often does the farmer renew seed of existing varieties ?
8. What are the seed rates used for the following crops :—

(a) Rice
(b) Wheat
(c) Corn
(d) Sorghum
(e) Cotton
(f) Peanut
(g) Soybean
(h) Potato

II. Seed Production :

1. What are the present arrangements for the production of breeder seed ?
2. What are the procedures, methods, periodicity and quantities of supply of breeder seed ?
3. What is the present organization and arrangement for production of foundation seed of :—

(a) Varieties
(b) Hybrids

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4. What are the procedures, methods, periodicity and quantities of supply of foundation seed ?
5. What arrangements exist for multiplication of commercial seed by Companies/Public Agencies if any ? (Model contract forms, if any, may be enclosed).
6. What is the basis of selection of seed production areas/seed growers, by seed companies ?
7. What incentives are provided for achieving maximum seed yields per acre and also for maintenance of high quality of seed ?
8. What proportion of the total commercial seed production is certified by an independent agency ?
9. If certification by an outside agency is not used, what measures are adopted for ensuring quality of commercial seeds ?

III. Seed processing. Backing and Storage :

1. What methods are currently adopted for processing of seeds of the following crops :—

(a) Rice.
(b) Wheat.
(c) Corn.

(d) Sorghum
(e) Cotton
(f) Peanut
(g) Soybean
(h) Potato

2. What in your opinion should be the optimum size of a processing plant ?

3. What are the essential processing equipment that should be installed in a processing plant ?

4. Give photographs of particulars of machinery, if possible.

5. What would be the requirement of personnel in a processing plant ? Give approximate cost.

6. What would be the best arrangement for packing of seeds in order to retain the viability and facility of transport ? Sample of packing material, where possible, may be enclosed.

7. What arrangements are made for storage of seeds ?

IV. Seed Marketing :

1. What policies are adopted for procurement of seeds from farmers particularly in regard to fixation of purchase prices ?

2. What are the policies adopted for development of markets and for having an effective distribution system ?

3. What are the normal margins ? What are the purchase prices of seeds from farmers and selling prices of seeds in respect of the following crops :—

(a) Rice
(b) Wheat
(c) Corn
(d) Sorghum
(e) Cotton
(f) Peanut
(g) Soybean
(h) Potato

4. How much of the above margin pertains to retailing ?

5. What are the arrangements for :—

(a) obtaining sufficient finance for installation of processing plants ;

(b) purchase and holding of stocks ; and

(c) fixed and working capital requirements ?

6. What special steps are taken for promoting new varieties of seeds amongst farmers ? What role is played by official extension agencies for sales promotion and for seed industry ?

7. What are the basic qualifications of marketing personnel and what arrangements are made for training of such personnel ?

8. Who actually sells the seeds ? What are the arrangements for retail sales ?

V. Seed Certification :

1. What are the main advantages that you see in a seed certification programme ?

2. Should seed certification include the certification for physical purity and germination in addition to genetic purity ?

3. What per cent of the seed of major crops is being certified ?

4. As a seed organization, what are the advantages and disadvantages to seed certification as it is conducted in your country ?
5. Who is responsible for the seed certification programme ?
6. Do you feel that your seed certification agency provides good and effective services ?
7. How is your seed certification work organized, i.e., who does the inspection, sampling, testing and so forth ?

VI. Seed Testing :

1. Are all of the seed testing laboratories in the country Government operated ?
2. Do seed firms also maintain seed testing units ? If so, do these units test seed officially or just for the internal use of the organization ?
3. How many government-sponsored seed testing laboratories exist in the country ?
4. Approximately how many samples are these seed laboratories testing ?
5. How long does it take to receive reports from laboratories ?
6. Are any shorter procedures such as tertozolium testing, X-ray analysis or other techniques incorporated into the seed testing programme ? If so, how ?

VII. Seed Law Enforcement :

1. Do you have a seed law ?
2. What are the essential points of the law ?
3. Who is incharge of enforcing the law ?
4. What procedures are adopted by the seed law enforcement personnel ?
5. How many people are involved in enforcing the seed law ?
6. Do you prepare reports summarizing the results of the seed law enforcement programme ?
7. What difficulties do you experience in enforcing the seed law ?
8. What impact do you feel the seed law has had on your seed programme ?
9. Since how long has the seed law been in force ?

VIII. Complaints :

1. Are there any complaints received from the seed buyers in respect of :—
   (a) Commercial seed ;
   (b) Foundation seed ;
   (c) Certification ;
   (d) Performance of variety ; and
   (e) Any other matter.
2. What are the nature of these complaints or grievances ?
3. What arrangements exist for dealing with complaints ?

IX. Seed Grower and Seed Dealer Organizations :

1. Do you have any seed grower or seed dealer organization ?
2. If so, what role does it play ?

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APPENDIX—I.

QUESTIONNAIRE

Planning of Seed Production

1. (i) What is the prescribed procedure for release of new varieties of agricultural and horticultural crops ?

(ii) Is there a duly constituted Variety Release Committee in your State ?

(iii) Who are its members and what are its functions ?

(iv) What is its relation to the Central Variety Release Committee ?

(v) Have you any suggestion in regard to the functioning of the Central and State Variety Release Committees ?

2. Is there any time-lag between evolving of new varieties and their official release ? What are your suggestions for reducing such time-lag ?

3. In many agriculturally advanced countries research and breeding was initially done by public agencies but as the seed industry developed substantial breeding work has been undertaken by private organizations who have evolved new varieties and hybrids. What measures in your opinion would be necessary for encouraging breeding work in the seed industry in various sectors ?

4. There are divergent procedures for registration, release and recommendation of varieties in different countries. In some countries all varieties whether evolved by public or private organizations have to be registered and released before they could be marketed. Such registration and release is done after the registration agency satisfies itself that the new variety is distinct from existing varieties and is superior to them in yield, disease resistance or other desired characteristics.

In some other countries the registration and release of varieties is done after the registration agency satisfies itself that the new variety is distinct from existing varieties. The condition that the new variety should be superior to existing varieties is not insisted on the ground that this will be judged ultimately by farmers themselves who will purchase the seeds and breeder of the variety satisfies himself before submitting the variety.

In some other countries there is no registration and official release of varieties. Any variety or kind of seed could be marketed, but truthful labelling of the seeds would be mandatory even in such countries.

In one country the system of voluntary registration exists, that is, such of the breeders as may like to have their variety registered after testing could apply for registration. Only the varieties which are so registered would be eligible for "breeders' rights".

In Your Opinion:—

(i) is a scheme for registration of varieties necessary or desirable ?

(ii) in case you consider such registration as necessary and desirable, what should be the procedure for testing ? How many years of trial would be necessary ? Who should conduct these tests ?

(iii) should the test be confined for the establishment of the distinguishing characteristics of the variety or should the economic superiority also be tested ?

(iv) should a scheme for registration and release of varieties be optional or compulsory ?

(v) what agencies would be most suitable for screening, registration and release of varieties?

5. In some countries a system of "breeders' rights" exists. Under such a system a certain royalty is paid to the plant breeder whether he is employed in a public agency or a private company based on the quantum of certified seeds sold of the variety evolved by the plant breeder,

The royalty goes as income to the institution employing the plant breeder. Do you think that such a system of "breeders' rights" should be introduced in India? How should this be linked with the procedure for registration of varieties ?

6. To whom may breeding material be supplied ?

7. Is there any undue time-lag between release of new varieties and extensive availability of seed of the varieties released ? If so, what measures could be adopted to cut short the time-lag ?

8. What percentage of seeds sown by the farmers in your State is purchased by the farmers from the approved sources each year ? This information may be furnished in respect of the principal crops.

9. What are the seed rates used for the following crops in your State ?

Crop		Irrigated Area	Unirrigated Area
Rice	..		
Wheat	..		
Maize	..		
Sorghum	..		
Bajra	..		
Cotton	..		
Groundnut	..		
Soybean	..		
Potato	..		
Important Vegetables	..		

Seed production

1. What are the present arrangements for the production of breeder seed ?

2. What are the procedures, methods, periodicity and quantities of supply of breeder seed ?

3. What is the present organization and arrangements for production of foundation seed of (a) hybrids, (b) other varieties ?

4. What are the procedures, methods, periodicity and quantities of supply of foundation seed of (a) hybrids, (b) other varieties ?

5. What agencies are best suited for maintenance of breeder stock seed and foundation seed in respect of (a) hybrids, (b) other varieties of cereals, grasses, fodder crops, commercial crops and vegetables. The agencies could be State or Central Departments of Agriculture, State and National Seeds Corporation, Indian Council of Agricultural Research, Seed Companies and other private sector organizations, agricultural universities, research institutes, associations of seed growers and co-operatives. Please indicate the responsibility which you think should be undertaken by these agencies ?

6. In the early years of release of a variety the quantum of breeder or foundation seed could be limited. What criteria or procedures and safeguards would you suggest for the allocation of such limited seed to seed growers for multiplication ?

7. What incentives exist or should be provided for achieving maximum seed yields per acre and for maintenance of high quality of seed ?

8. Where certified or approved seeds are not available, what methods are adopted by farmers in selecting good seeds ?

9. What is the average seed yield per acre in respect of the following crops in your area.

Crop	Irrigated Area	Unirrigated Area
Rice		
Wheat		
Maize		
Sorghum		
Bajra		
Cotton		
Groundnut		
Soybean		
Potato		
Important Vegetables		

10. What are the main problems faced in seed production in your area ?

11. It is known that for seed production of cross-pollinated crops, particularly of hybrids, considerable isolation is required, i.e., crop should be grown at a certain distance to prevent contamination from other varieties. How is such isolation ensured in your State ? Is there any legislation or other official measures used in this regard ?

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12. In addition to irrigation, drainage and other inputs, seed production requires proper land shaping. Are the arrangements adequate in this regard ? Have you any suggestions for further improvement in this direction ?

Seed Processing, Packing and Storage

1. What are the present methods used by farmers and seed growers for sorting, drying, cleaning and treating in respect of different kinds of seeds ?

2. Is any machinery used for these purposes ? Indicate the same giving sources of availability of such machinery indigenously ?

3. What are the difficulties experienced in obtaining processing equipment ? Have you any suggestions for overcoming these difficulties ? Are there any item of equipment required but not readily available ?

4. Do you anticipate greater use of processing equipment, if made available ?

5. What do you feel would be your annual requirements of different items of equipment in your State ?

6. What in your opinion should be the optimum size of a processing plant ? What would be the requirement of personnel in such a processing plant ? Give your estimate of the cost of processing per quintal for different crops in such a plant ?

7. What would be the best arrangement for packing of seeds in order to retain the viability as well as to ensure facility of transport ?

8. Indicate the need and scope of using the following packing materials for retail as well as bulk packing. Give an estimate of relative costs, if possible.

1. Cloth.
2. Jute.
3. Polythene.
4. Polythene lined jute
5. Multi-walled paper..
6. Aluminium foil.

9. It is seen that seeds are dried artificially and canned in certain countries. Particularly, vegetable seeds are dried to a low moisture percentage and canned, as such canning can preserve the viability of seeds under tropical and humid conditions. What would be the scope for such drying and canning under Indian conditions ?

10. What are the present arrangements for storage of seeds of different crops ? Are these arrangements adequate ? Have you any suggestions in this ragard ?

11. It is said that under tropical conditions it is easier and cheaper to preserve the viability of seeds by humidity control than by having temperature control. Have you any suggestions in this regard ?

SEED MARKETING

1. What are the existing arrangements for marketing and distribution of seeds by Government, Co-operatives, private or other agencies ? Indicate position both at the wholesale and the retail levels ?

2. Marketing by seed producers has not yet fully developed. What are the difficulties faced in this regard ? What special measures would you recommend to overcome such difficulties ?

3. At present large quantities of seeds are purchased by Government as well as other agencies. What are the prevelant prices for purchase of seeds from farmers ? What criteria are adopted for fixation of such prices ?

4. A proper price level for seed ensures production of quality seed so essential for increasing agricultural production and profitability to the farmer. Do the present purchase and sale prices of seeds provide adequate incentives at the stage of—

(a) production of seed;

(b) distribution (wholesale seed marketing, retail for progressive growth of activities at all the stages at the same time ensuring quality).

5. What are the arrangements for obtaining sufficient finance (a) for installation of processing plants (b) for purchase and holding of seed stocks (c) for other working capital requirements ?

6. Have you any suggestions in regard to the credit facilities to be provided to seed industry ?

7. What special incentives would you suggest as necessary and desirable for the development of seed industry ?

SEED TESTING

1. To what extent are seed growers, farmers and seed producers making use of the seed testing laboratory in your State for testing germination, purity and moisture content ?

2. Are the facilities for seed testing at the laboratory adequate ? Have you any suggestions for their strengthening ?

3. It is observed that seed testing laboratories generally provide for two types of testing—

(a) testing of official samples drawn by certification agencies and seed inspectors ;

(b) testing of service samples sent by seed companies, seed growers and farmers.

To what extent are these services provided in your State ?

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4. Approximately how many samples are tested in different crops under the two categories mentioned above ?

5. What are the fees charged, if any, for testing of samples in respect of —

(a) Germination

(b) Purity

(c) Moisture content.

6. How long does it take to obtain results of test from laboratories ?

7. Are any quick testing procedures such as tetrrzolium test, X-ray analysis other techniques adopted to save time ? If so, with what results ?

SEEDS ACT

Under the Seeds Act recently passed by the Parliament, the Central Government may notify any kind or variety of seeds for any specified area and once a kind or variety of seeds is notified, the Central Government may also fix the minimum limits of germination and purity and require that the commercial seed (other than the exempted categories under Section 24 of Seeds Act) should be sold in containers with a mark or label indicating that the seed conforms to the minimum limits of germination and purity. No person can offer to sell in commercial channels any notified seed unless it is identified to its kind or variety and also conforms to the minimum limits of germination and purity and is sold in a container with the correct label. In effect what the law requires is that all notified seeds shall be truthfully labelled so that the farmers know the real kind and variety and quality of the seeds.

In addition to this provision for truthful labelling, the Seeds Act also provides that the State Governments or the Central Government in consultation with the State Governments may establish certification agencies for different States. Certification of a notified kind or variety is voluntary and any person who desires to avail of the services of such certification agency can apply to the agency and have his seed certified in accordance with the procedures to be prescribed under the Act. It will be noticed that while truthful labelling is compulsory in respect of notified seeds, certification is voluntary.

Bearing this Seeds Act in mind:—

(i) have you all the facilities required for the successful implementation of both the truthful labelling and seed certification aspects of the Seeds Act ?
(ii) are the requisite trained personnel available ?
(iii) can the mobility of the inspection staff be assured ? If so how ?
(iv) to what crops and regions should the Seeds Act be applied in the first instance ?
(v) what agency should be entrusted with the task of —

(a) enforcement of the Seeds Act other than certification ?

(b) certification.

The agencies to be considered would be the State or Central Departments of Agriculture, State/National Seeds Corporation, agricultural universities, associations of seed growers, agricultural research institutes. What agency or group of the above list or combination of these or any other agency would you recommend to perform the above tasks and give reasons if any ?

(vi) how will such an agency be financed ?

(vii) how would you ensure that the certifying agency is independent of the seed production agency to maintain its objectivity ?

3. The main objective of the Seeds Act is to provide safeguards to farmers, good seed producers and seed dealers against indifferent and unscrupulous seed dealers and producers. In what directions can the seed trade give its fullest cooperation in the implementation of the Seeds Act ? What measures are required to secure the same ?

In what directions can the seed trade contribute to the fulfilment of the objective ?

Complaints

1. Are there any Complaints received from the seed buyers in respect of :

   (a) Commercial seed ;
   (b) Foundation seed ;
   (c) Certification ;
   (d) Performance of variety ;
   (e) Any other matter.

2. What are the nature of these complaints or grievances ?

3. What arrangements exist for dealing with complaints ?

4. Have you any suggestions in this regard ?

Seed Grower and Seed Dealer Organizations

1. Do you have any seed grower or seed dealer organization ?

2. If so, what role do they play.

3. If you do not have any organization of seed growers and seed dealers, do you think there is any need for formation of such an organization in your area. What in your opinion can be their most useful role ?

Training

1. Are there adequate training facilities in respect of :

   (a) seed certification work ;
   (b) seed analysis and seed testing work ;
   (c) seed production ;
   (d) seed marketing.

   If so, furnish details of the courses available ?

2. Have the universities or agricultural colleges instituted courses in seed technology ? Indicate details thereof.

3. Have you any suggestions for the organization of training in various aspects referred to above in different levels ? (Blocks, Districts, State and Centre or abroad).

4. Several people have received training in seed technology at Delhi and abroad duringt he past five years. What percentage of these people are being used in your seed programme ? Have you any suggestions to ensure that their special training and knowledge are fully utilized in their special fields ?

5. Is your State specially suitable for seed production of any particular crop, hybrid or other varieties ? Would the State be in a position to meet its own requirements of such seed and to supply to other States ? What facilities would be required to develop seed production of all other kinds and varieties of seeds ?

6. What role do you think should be assumed by the agencies listed below in various phases of seed industry such as breeder seed stock production, foundation seed production, registered seed production, seed processing, seed distribution, seed marketing, seed certification, seed testing, seed law enforcement, training for seed production, etc.

Agencies

Central Department of Agriculture
State Department of Agriculture
National Seeds Corporations
State Seeds Corporations
Co-operatives at various levels
Agricultural Universities
Research Institutes
Indian Council of Agricultural Research
Seed Growers' Organizations
Seed Companies.

In addition to answering the various questions given in this questionnaire you might have other remarks or suggestions to offer for the rapid development of a healthy and vigorous seed industry. We shall be grateful if you could indicate the same at the end of this questionnaire.

APPENDIX—C III

STATISTICAL TABLES

Seed Renewal periods (years)

Paddy	..	Four (4)
Wheat	..	Five(5)
Maize	..	Three (3)
Sorghum	..	Three (3)
Bajra	..	One (1)
Ragi	..	Five (5)
Barley	..	Five (5)
Gram	..	Five (5)
Groundnut	..	Five (5)
Cotton	..	Five (5)
Jute	..	Five (5)
Tur	..	Three (3)

(Seed Rates Kilograms per acre)

Serial No.	State	Paddy	Wheat	Maize	Sorghum	Bajra	Ragi
1.	Andhra Pradesh ..	15	30*	6.5	4	2	..
2.	Assam ..	15*	30*	6.5*	..	..	..
3.	Bihar ..	12	30	6.5	3	2*	..
4.	Gujarat ..	15	30	6.0	4	2	..
5.	Haryana ..	10	40	8.0	4*	1.5	..
6.	Jammu & Kashmir ..	15*	30*	6.5*	4*	2	..
7.	Kerala ..	15	..	..	4*	..	..
8.	Madhya Pradesh ..	15*	30*	6.5*	4*	2*	..
9.	Madras ..	15	45	8.0	5	1.5	..
10.	Maharashtra ..	15	40	6.0	3	2	..
11.	Mysore ..	10	35	6.5	4	1.5	..
12.	Orssa ..	15*	30*	6.5*	4*	2*	..
13.	Punjab ..	8	30	6.5	6	1.5	Four Kilograms per acre (4 kg/ acre)
14.	Rajasthan ..	10	45	6.0	3	1.25	
15.	Uttar Pradesh ..	10	35	8.0	5	2	..
16.	West Bengal ..	15*	30*	6.5*	4*	2*	..
17.	Delhi ..	10	35	6.0	4*	2.5	..
18.	Goa, Daman, and Diu ..	12	..	..	..	..	..
19.	Himachal Pradesh ..	15*	*39	6.5*	..*	2	..

Serial No.	State	Paddy	Wheat	Maize	Sorghum	Bajra	Ragi
20.	Manipur ..	15*	..	6.5*	..	..	..
21.	NEFA ..	15*	..	..	..	..	..
22.	Tripura ..	15*	..	..	..	..	..
23.	Andaman and Nicobar Islands ..	15*	..	..	..	..	..
24.	Nagaland ..	15*	..	..	..	..	..
25.	Pondicherry ..	15	..	..	..	2	..

Barley	Gram	Groundnut	Cotton	Jute	Tur
Twenty Kilogram/acres	25 kilogram/acre	35	3	Four kilograms per acre	Four kilograms per acre
(20 kgs/acre)		..	5	4 kgs/acre	4 kgs/acre
		35	5*		
		30	4		
		30	10		
		..	5*		
		35*	5*		
		35*	5*		
		40	5		
		30	4		
		35*	5*		
		35*	5*		
		32	6		
		25	8		
		30	6		
		..	..		
		30	5*		
		40	..		
		35*	5*		
		..	..		
		..	..		
		..	..		
		..	..		
		..	..		
		35*	5*		

Seed Yields
(Quintals per acre)

Serial No.	State	Paddy	Wheat	Maize	Sorghum	Bajra
1.	Andhra Pradesh	10	5	5½	5	2
2.	Assam	9½*	8*	7*	..	..
3.	Bihar	15	13	13	3½*	2½*
4.	Gujarat	4½	6	6	3½*	3
5.	Haryana	5	6	5	1	2
6.	Jammu & Kashmir	3½*	8*	7*	3½*	2½*
7.	Kerala	10	..	..	3½*	..
8.	Madhya Pradesh	12	10	6	3½*	2½*
9.	Madras	15	20	8	4	4
10.	Maharashtra	8	6	8	7	5
11.	Mysore	10	5	10	4	4
12.	Orissa	9½	8*	7*	3½*	2½*
13.	Punjab	4	5	6½	1	2
14.	Rajasthan	9½	8*	7*	3½*	2½*
15.	Uttar Pradesh	5½	4½	4	3	3
16.	West Bengal	9½*	8*	7*	3½*	2½*
17.	Delhi	12	12	6	3½*	2½
18.	Goa, Daman and Diu	9½*	..	..	..	..
19.	Himachal Pradesh	9½*	8	7*	..	2½*
20.	Manipur	9½*	..	7*	..	..
21.	NEFA	9½*	..	..	..	..
22.	Tripura	9½*	..	..	..	..
23.	Andaman and Nicobar Islands	9½*	..	..	..	..
24.	Nagaland	9½*	..	..	..	..
25.	Pondicherry	12	..	..	..	2½*

N. B.—Figures at '*' indicate that they are pure assumptions while the rest are as per the replies received from the State for the Seed Team's Questionnaire.

Ragi	Barley	Gram	Groundnut	Cotton	Jute	Tur
Four Quintals per acre	Two and half quintals per acre	Six Quintals per acre	5½	3½	One and half quintals per acre	Three and half quintals per acre
			..	2*		
(4 Qtls/acre)	(2.5 Qtls/acre)	(6.0 Qtls/acre)	4*	2*	(1.50 Qtls/acre)	(3.5 Qtls/arce)
			3	3*		
			4	1.1		
			..	2*		
			7	2*		
			1.3	2*		
			5	2*		
			3	2*		
			4*	2*		
			4*	2*		
			4*	2		
			4*	2*		
			5	2*		
			..	2*		
			..	2*		
			..	2*		
			4*	2*		
			..	..		
			..	..		
			..	2*		
			..	..		
			..	..		
			4	2*		

(Prices in Rs/qtl)

Serial No.	Crop	Price
1.	Paddy	45.00
2.	Wheat	75.00
3.	Maize	56.00
4.	Sorghum	45.00
5.	Bajra	50.00
6.	Ragi	50.00
7.	Barley	60.00
8.	Gram	75.00
9.	Groundnut	150.00
10.	Cotton	50.50
11.	Jute	400.00
12.	Tur	95.00

N. B.—(i) The price of jute assumed is the seed price at which National Seeds Corporation sells the certified seed.

(ii) *Source* : Bulleton of Agricultural prices Vol. XVIII (New Series) No. 9 issued by the Economics and Statistical Adviser to the Government of India.

(iii) The prices are for the week ending 1st March, 1968.

TOTAL AREA IN LAKH ACRES UNDER VARIOUS CROPS IN THE DIFFERENT STATES AND UNION TERRITORIES OF INDIA

Serial No.	State		Paddy	Wheat	Maize	Jowar	Bajra	Ragi	Barley	Ground nut	Gram	Cotton	Jute	Tur	Total
1.	Andhra Pradesh	..	86.45	0.31	5.19	60.39	5.72	8.10	..	1,726.19		7.93	..	4.07	206.06
2.	Assam	..	50.13	0.14	0.58	..	..	..	..	@		0.41	3.36	@	54.62
3.	Bihar	..	111.04	20.51	22.16	0.22	0.32	4.09	8.74	730.09		@	3.96	4.29	182.75
4.	Gujarat	..	12.56	11.38	5.70	34.31	42.42	1.56	@	1.58	—	42.96	..	2.14	203.09
5.	Haryana	..	4.69	18.59	2.31	6.59	22.25	@	4.10	2,640.25	—	4.52	..	0.16	89.86
6.	Jammu & Kashmir	..	5.52	4.57	5.94	@	0.27	..	0.44	@	—	@	..	..	16.74
7.	Kerala	..	19.85	..	..	@	..	0.12	..	0.323	—	0.16	..	0.19	20.65
8.	Madhya Pradesh	..	105.16@	50.54	12.93	52.83	5.08	0.39	2.87	3,813.26	—	20.20	..	10.74	312.99
9.	Madras	..	65.75	@	@	18.37	11.52	8.11	@	@22.50	—	10.06	..	1.27	137.64
10.	Maharashtra	..	33.97	22.64	1.48	152.51	44.36	5.68	@	825.93	—	64.21	..	13.89	373.28
11.	Mysore	..	26.38	6.74	0.37	68.97	10.83	22.70	@	320.27	—	24.28	..	5.58	189.89
12.	Orissa	..	105.05	0.38	1.40	0.10	0.12	3.14	@	01.62	—	11.51	1.05	0.87	125.74
13.	Punjab	..	6.69	40.68	10.35	0.12	4.54	@	2.85	154.48	—	6.17	..	@	91.41
14.	Rajasthan	..	1.93	23.34	10.25	27.57	124.77	..	10.81	284.90	—	1.66	..	0.64	242.23
15.	Uttar Pradesh	..	111.49	109.40	30.83	22.18	24.98	4.05	38.15	609.88	—	..	0.52	16.29	428.15
16.	West Bengal	..	114.82	1.56	1.21	@	@	0.20	1.33	4	—	@	10.45	1.01	135.34
17.	Delhi	..	@	0.80	@	0.25	0.41	..	0.12	..	—	..		..	1.85
18.	Goa, Daman and Diu	..	0.90	..	..	..	..	..	..	..	—	@	..	..	0.90
19.	Himachal Pradesh	..	2.38	7.07	5.94	..	@	0.32	0.96	@	—	..	..	..	18.01
20.	Manipur	..	3.97	..	0.18	..	..	..	..	..	—	..	..	..	4.15
21.	N.E.F.A	..	1.28	..	..	..	..	..	..	..	—	..	..	..	1.28
22.	Tripura	..	6.16	..	..	..	..	..	..	..	—	@	0.33	..	6.50
23.	Andaman and Nicobar Islands	..	0.17	..	..	..	..	..	..	..	—	..	..	..	0.17
24.	Nagaland	..	1.98	..	..	..	..	..	..	..	—	..	..	..	1.98
25.	Pondicherry	..	0.80	..	..	..	@	@	..	..	—	@	..	..	0.80
	Total	..	879.13	319.65	124.82	444.47	297.59	58.52	70.37	197.91	—	194.07	19.67	61.14	2,846.08

Note.—Source : Summary tables of area production and yield of principal Crops in India 1949-50 to 1966-67. Dirctorate of Economics and Statistics, G.O.I.
The figures at @ indicate that they are less than lakh acres

(a) Total quantity of Seed used over the entire area, and

(b) Total Quantity of Seed required annually on the basis of seed renewal period (Statewise)

(in '000 metric tonnes)

		(a)	(b)
1. Andhra Pradesh	..	264·00	65·80
2. Assam	..	77·70	19·40
3. Bihar	..	250·50	59·00
4. Gujarat	..	234·60	56·40
5. Haryana	..	166·40	36·80
6. Jammu and Kashmir	..	27·10	6·40
7. Kerala	..	31·20	7·70
8. Madhya Pradesh	..	516·20	116·00
9. Madras	..	127·70	49·30
10. Maharashtra	..	329·90	82·60
11. Mysore	..	183·40	43·30
12. Orissa	..	168·80	41·80
13. Punjab	..	200·90	41·90
14. Rajasthan	..	252·40	65·70
15. Uttar Pradesh	..	801·50	175·50
16. West Bengal	..	196·90	48·20
17. Delhi	..	4·10	0·90
18. Goa, Daman and Diu	..	1·10	0·30
19. Himachal Pradesh	..	40·90	8·90
20. Manipur	..	6·10	1·50
21. N.E.F.A.	..	1·90	0·50
22. Tripura	..	9·40	2·30
23. Andaman and Nicobar Islands	..	0·30	0·07
24. Nagaland	..	3·00	0·70
25. Pondicherry	..	0·40	0·10
		3,896·40	931·07

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N.B.—For crops of Paddy, Wheat, Maize, Jowar, Bajra, Ragi, Barley, Gram, Groundnut, Cotton, Jute and Tur only.

Total Seed Requirements (Cropwise)

		(In '000 metric tonnes)
1.	Paddy	1,194.70
2.	Wheat	1,122.80
3.	Maize	84.90
4.	Sorghum	163.90
5.	Bajra	49.70
6.	Ragi	23.40
7.	Barley	141.30
8.	Gram	494.90
9.	Groundnut	508.20
10.	Cotton	90.30
11.	Jute	7.80
12.	Tur	24.50
		3,896.40

Annual Seed Requirements (Cropwise)

		(In '000 metric tonnes)
1.	Paddy	298.70
2.	Wheat	222.50
3.	Maize	28.30
4.	Sorghum	54.60
5.	Bajra	49.70
6.	Ragi	4.70
7.	Barley	28.20
8.	Gram	98.90
9.	Groundnut	117.80
10.	Cotton	18.00
11.	Jute	1.57
12.	Tur	8.10
		931.07

Area to be put under certified registered III final and II final stage to produce seed sufficient to meet annual requirement

(Statewise)

Serial No.	State	Area
		('00 acres)
1.	Andhra Pradesh	1,058.10
2.	Assam	221.60
3.	Bihar	607.90
4.	Gujarat	1,683.00
5.	Haryana	910.60
6.	Jammu & Kashmir	84.50
7.	Kerala	78.70
8.	Madhya Pradesh	2,172.80
9.	Madras	715.40
10.	Maharashtra	1,772.00
11.	Mysore	1,045.30

(continued)

Serial No.	State		Area
			('00 acres)
12.	Orissa	..	470.70
13.	Punjab	..	908.10
14.	Rajasthan	..	1,544.50
15.	Uttar Pradesh	..	4,021.00
16.	West Bengal	..	589.40
17.	Delhi	..	15.00
18.	Goa, Daman and Diu	..	3.00
19.	Himachal Pradesh	..	123.11
20.	Manipur	..	16.60
21.	N.E.F.A.	..	5.00
22.	Tripura	..	26.40
23.	Andaman, and Nicobar Islands	..	1.00
24.	Nagaland	..	8.00
25.	Pondicherry	..	1.40
			18,083.11

N.B.—(i) Certified stage applies to paddy, maize, sorghum, bajra, ragi, jute and tur.

(ii) Registered III applies to groundnut.

(iii) Registered II applies to wheat, barley, gram and cotton.

Area to be put under certified/registered II final and sregistered III final for meeting annual requirement

(Crop wise)

Serial No.	Crop		Area
			('00 acres)
1.	Paddy	..	3,095.00
2.	Wheat	..	3,769.00
3.	Maize	..	482.60
4.	Jowar	..	1,312.00
5.	Bajra	..	1,783.60
6.	Ragi	..	114.80
7.	Barley	..	1,130.30
8.	Gram	..	1,647.20
9.	Groundnut	..	3,555.60
10.	Cotton	..	854.01
11.	Jute	..	106.00
12.	Tur	..	233.00
	Total	..	18,083.11

QUANTITY OF FOUNDATION SEED REQUIRED—

(i) TO COVER AREA UNDER CERTIFIED SEED PRODUCTION.

(ii) TO COVER AREA UNDER REGISTERED SEED PRODUCTION FOR REGD. (Final).

(iii) TO COVER AREA UNDER REGISTERED SEED PRODUCTION FOR (Middle).

(Statewise)

(Metric Tonnes)

Serial No.	State		
1	Andhra Pradesh	..	613.12
2	Assam	..	305.40
3	Bihar	..	343.50
4	Gujarat	..	189.10
5	Haryana	..	198.76
6	Jammu & Kashmir	..	49.30
7	Kerala	..	112.35
8	Madhya Pradesh	..	881.20
9	Madras	..	310.00
10	Maharashtra	..	472.30
11	Mysore	..	233.18
12	Orissa	..	645.30
13	Punjab	..	87.64
14	Rajasthan	..	260.60
15	Uttar Pradesh	..	1,411.50
16	West Bengal	..	713.40
17	Delhi	..	2.50
18	Goa, Daman and Diu	..	3.00
19	Himachal Pradesh	..	41.30
20	Manipur	..	24.40
21	N.E.F.A.	..	8.00
22	Tripura	..	38.20
23	Andaman and Nicobar Islands	..	1.00
24	Nagaland	..	12.00
25	Pondicherry	..	0.40
		..	6,957.65

Quantity of Foundation Seed required to cover area under certified and registered I for registered II and registered I for registered II middle

(Cropwise) (In metric tonnes)

	For Certified Seed Production	For registered I for Regd. II Final	For registered I for Regd. II Middle	Total
1. Paddy	4,218.40	..	..	4,218.40
2. Wheat	..	778.00	..	778.00
3. Maize	338.10	..	..	338.10
4. Sorghum	512.20	..	..	512.20
5. Bajra	292.20	..	..	292.20
6. Ragi	46.90	..	..	46.90
7. Barley	..	180.20	..	180.20
8. Gram	..	171.90	..	171.90
9. Groundnut	..	..	253.85	253.85
10. Cotton	..	18.60	..	18.60
11. Jute	42.10	..	..	42.10
12. Tur	105.20	..	..	105.20
Total	5,555.10	1,148.70	253.85	6,957.65

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AREA TO BE PUT UNDER FOUNDATION SEED PRODUCTION

(Statewise) (In Acres)

Serial No.	State	Area
1	Andhra Pradesh	840.60
2	Assam	362.60
3	Bihar	383.70
4	Gujarat	537.50
5	Haryana	783.20
6	Jammu & Kashmir	163.00
7	Kerala	113.30
8	Madhya Pradesh	2,057.30
9	Madras	319.30

(In Area)

Serial No.	State		Acrea
10	Maharashtra	..	746.50
11	Mysore	..	508.10
12	Orissa	..	723.10
13	Punjab	..	219.60
14	Rajasthan	..	676.40
15	Uttar Pradesh	..	3,243.80
16	West Bengal	..	891.70
17	Delhi	..	10.30
18	Goa, Daman and Diu	..	4.00
19	Himachal Pradesh	..	57.00
20	Manipur	..	25.50
21	NEFA	..	8.00
22	Tripura	..	45.25
23	Andaman and Nicobar Islands	..	1.00
24	Nagaland	..	12.00
25	Pondicherry	..	1.40
	Total	..	12,634.15

Area under Foundation Seed Production for use in registered I, registered II middle and Certified Seed Production (Cropwise)

(In acres)

Serial No.	Crop		Area
1	Paddy	..	4,612.20
2	Wheat	..	1,504.20
3	Maize	..	671.00
4	Sorghum	..	1,318.80
5	Bajra	..	1,112.20
6	Ragi	..	115.20
7	Barley	..	720.00
8	Gram	..	282.10
9	Groundnut	..	1,601.25
10	Cotton	..	117.60
11	Jute	..	278.00
12	Tur	..	301.60
	Total	..	12,634.15

Quantity of Breeder Seed required
(Statewise)

(In quintals)

Serial No.	Crop		Quantity
1	Andhra Pradesh	..	87.70
2	Assam	..	50.00
3	Bihar	..	46.00
4	Gujarat	..	51.50
5	Haryana	..	90.00
6	Jammu & Kashmir	..	17.60
7	Kerala	..	17.00
8	Madhya Pradesh	..	584.80
9	Madras	..	38.30
10	Maharashtra	..	125.60
11	Mysore	..	45.50
12	Orissa	..	101.40
13	Punjab	..	27.60
14	Rajasthan	..	75.80
15	Uttar Pradesh	..	601.25
16	West Bengal	..	118.40
17	Delhi	..	0.60
18	Goa, Daman and Diu	..	0.40
19	Himachal Pradesh	..	10.20
20	Manipur	..	4.00
21	N.E.F.A.	..	1.00
22	Tripura	..	6.30
23	Andaman and Nicobar Islands	..	..
24	Nagaland	..	2.00
25	Pondicherry	..	..
	Total	..	2,108.95

Quantity of Breeders Seed required

(Cropwise) (In Quintals)

Serial No.	Crop		Quantity
1	Paddy	..	628.87
2	Wheat	..	543.62
3	Maize	..	48.50
4	Sorghum	..	54.00
5	Bajra	..	15.20
6	Ragi	..	4.30
7	Barley	..	155.01
8	Gram	..	71.40
9	Groundnut	..	555.63
10	Cotton	..	9.21
11	Jute	..	11.10
12	Tur	..	12.10
	Total	..	2,108.95

Seed Value for Total Seed Requirement :—
(a) At grain prices and
(b) At 1½ times the grain prices

(Statewise)

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(In million rupees)

Serial No.	State		(a)	(b)
1	Andhra Pradesh	..	218.70	327.50
2	Assam	..	34.71	57.14
3	Bihar	..	140.67	218.34
4	Gujarat	..	273.48	410.62
5	Haryana	..	119.86	179.39
6	Jammu & Kashmir	..	16.72	25.24
7	Kerala	..	15.56	22.90
8	Madhya Pradesh	..	363.88	545.62
9	Madras	..	197.64	289.69
10	Maharashtra	..	273.20	402.80

Serial No.	State		(a)	(b)
11	Mysore	..	158.04	236.95
12	Orissa	..	82.76	125.88
13	Punjab	..	154.64	238.07
14	Rajasthan	..	185.55	280.80
15	Uttar Pradesh	..	568.80	855.20
16	West Bengal	..	91.83	155.15
17	Delhi	..	2.71	4.33
18	Goa, Daman and Diu	..	0.50	0.74
19	Himachal Pradesh	..	29.06	42.79
20	Manipur	..	3.70	4.10
21	NEFA	..	0.90	1.30
22	Tripura	..	4.02	6.76
23	Andaman and Nicobar Islands	..	0.10	0.20
24	Nagaland	..	1.00	2.00
25	Pondicherry	..	0.45	0.69
		..	2,938.48	4,434.16

Seed Value for Annual Seed Requirement—
(a) At lowest grain price
(b) At 1½ times the grain price

(Statewise)

(In million rupees)

Serial No.	State		(a)	(b)
1	Andhra Pradesh	..	25.00	74.72
2	Assam	..	8.70	14.05
3	Bihar	..	18.90	49.97
4	Gujarat	..	59.24	89.23
5	Haryana	..	25.28	37.92
6	Jammu & Kashmir	..	3.79	5.13
7	Kerala	..	3.72	6.66
8	Madhya Pradesh	..	78.61	119.11
9	Madras	..	41.29	62.12

(Continued)

Serial No.	State		(a)	(b)
10	Maharashtra	..	60.20	92.87
11	Mysore	..	36.85	55.33
12	Orissa	..	20.32	30.52
13	Punjab	..	31.91	48.32
14	Rajasthan	..	44.50	97.87
15	Uttar Pradesh	..	121.70	179.79
16	West Bengal	..	22.40	36.71
17	Delhi	..	0.60	1.12
18	Goa, Daman and Diu	..	0.10	0.20
19	Himachal Pradesh	..	6.04	9.52
20	Manipur	..	0.72	1.30
21	N.E.F.A.	..	0.20	0.30
22	Tripura	..	1.00	2.60
23	Andaman and Nicobar Islands	..	0.03	.04
24	Nagaland	..	0.30	.30
25	Pondicherry	..	0.86	.12
		..	612.26	1,016.02

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Seed Value of Total Seed Requirement
(i) At grain prices
(ii) At 1½ times the grain prices
(Cropwise)

(In milion rupees)

Serial No.	Crop		(i)	(ii)
1	Paddy	..	536.46	805.90
2	Wheat	..	842.90	1,251.60
3	Maize	..	52.94	70.88
4	Sorghum	..	63.12	93.94
5	Bajra	..	24.61	41.89
6	Ragi	..	11.50	17.39
7	Barley	..	84.10	127.05
8	Gram	..	370.68	556.30
9	Groundnut	..	882.60	1,324.90
10	Cotton	..	45.48	68.02
11	Jute	..	..	31.53
12	Tur	..	24.09	44.76
		..	2,938.48	4,434.16

Seed Value of :

(a) Foundation Seed Requirement at 3 times the grain price

(b) Breeder Seed Requirement at 6 times the grain prices

(Statewise)

Serial No.	State	(a) (Lakh Rs)	(b) ('000' Rs)
1	Andhra Pradesh	8·71	26.00
2	Assam	4·92	17·23
3	Bihar	5·88	19·85
4	Gujarat	3·78	33·86
5	Haryana	3·56	33·25
6	Jammu & Kashmir	0·71	6·00
7	Kerala	1·50	4·50
8	Madhya Pradesh	18·68	470·33
9	Madras	4·48	14·81
10	Maharashtra	8·04	54·12
11	Mysore	6·13	20·80
12	Orissa	9·20	29·57
13	Punjab	1·58	10·55
14	Rajasthan	6·95	33·10
15	Uttar Pradesh	26·46	240·45
16	West Bengal	12·14	45·17
17	Delhi	0·03	0·13
18	Goa, Daman and Diu	0·05	0·10
19	Himachal Pradesh	0·64	3·77
20	Manipur	0·30	1·00
21	N.E.F.A.	0·10	0·30
22	Tripura	0·58	1·93
23	Andaman and Nicobar Islands	0·01	..
24	Nagaland	0·20	0·50
25	Pondicherry	Negligible	0·01
	Total	124·63	1,067·33

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(i) Seed Value of Foundation Seed Requirement at 3 times the grain price (in lakh Rs).
(ii) Breeder Seed Requirement at 6 times the grain price (in '000' Rs).

(Cropwise)

Serial No.	Crop		(Lakh Rs.) (i)	(000 Rs.) (ii)
1	Paddy	..	57 ·03	168 ·65
2	Wheat	..	17 ·09	241 ·60
3	Maize	..	5 ·75	16 ·19
4	Sorghum	..	6 ·89	14 ·73
5	Bajra	..	4 ·35	5 ·53
6	Ragi	..	0 ·73	1 ·32
7	Barley	..	3 ·22	55 ·04
8	Gram	..	3 ·87	31 ·50
9	Groundnut	..	11 ·37	497 ·91
10	Cotton	..	5 ·09	0 ·86
11	Jute	..	6 ·28	26 ·60
12	Tur	..	2 ·96	7 ·40
	Total	..	124 ·63	1,067 ·33

Seed Value of Annual Seed Requirements—
(i) At lowest grain price.
(ii) At 1½ times the lowest grain price.

(Cropwise)

(In million Rs.)

Serial No.	Crop		(i)	(ii)
1	Paddy	..	120 ·68	201 ·44
2	Wheat	..	166 ·47	250 ·53
3	Maize	..	15 ·58	24 ·16
4	Sorghum	..	24 ·54	37 ·18
5	Bajra	..	24 ·82	37 ·65
6	Ragi	..	2 ·08	3 ·44
7	Barley	..	16 ·85	25 ·29
8	Gram	..	74 ·14	11128 ·
9	Groundnut	..	152 ·35	265 ·60
10	Cotton	..	8 ·56	12 ·96
11	Jute	..	..	7 ·20
12	Tur	..	6 ·19	39 ·29
	Total		612 ·26	1,016 ·02

APPENDIX-IV

PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

Policy governing Release of New Varieties of Soybeans and Small Grains.

I. No new variety is to be released until it is approved by the Agricultural Experiment Station Committee on the Release of New Plant Varieties and the Director.

II. The Agricultural Experiment Station will multiply or control the multiplication of seed until stocks are of sufficient quantity to assure distribution to an adequate number of producers in the area where allotted.

III. No initial release seed of a new variety will be distributed to:

(1) Any staff member or employee of Purdue University except for research and extension purposes.

(2) Growers outside the area of varietal recommendation or acceptability except where necessary to provide adequate multiplication of certifiable seed.

(3) Out of state agencies except through the supervision of the Agricultural Experiment Station of that state.

IV. Seed will be offered for distribution in amounts determined in advance by the Agricultural Experiment Station for each variety release and may be restricted to, or allotted among, specific regions of the state.

V. *Method of distribution.*—(1) Allotments of seed will be made directly to Indiana certified seed producers by the Agricultural Experiment Station.

When seed supplies will not meet all demands the seed will be allotted following the plan described below (items 2, 3 and 4).

(2) *Classification of Certified Seed Producers.*—Seed producers will be classified based on completion of certain steps in certification and on average acreage certified for a designated period described below. Certification is defined as completed when Indiana certification tags are issued either to the original producer or his own bulk transferee on a minimum of 200 bushels or 1/4th of the lot, whichever is smaller. In addition, certification will be considered completed for allotment purposes whenever certification cannot be completed for reasons beyond the grower's control. Such reasons may include:

(a) low germination or distinctly low seed quality caused by disease or by unusual environmental conditions.

(b) Loose smut in wheat.

(c) hail or flood.

(d) other natural disasters.

Certification of "reasons beyond the grower's control" must be requested in writing to the Seed Certification Service and be verified by them. Further, appeal is provided in special cases elsewhere in this release policy.

Class I.—Seed producers who had fields inspected for the crop in each of the three previous years and who completed certification as defined above for two of the three previous years with minimum three-year average of 10 acres certified. The three year period does not include the crop seeded in the year prior to release since certification usually is not completed for this crop at the time of allotment.

Class II.—Seed producers completing certification of the crop as previously defined for one of the previous three years.

Class III.—Certified seed producers of other crops.

(3) If seed supplies are adequate, all producers in Class I will receive one allotment, with the amount in even bushels determined for each release by the Agricultural Experiment Station. Seed supplies available for allotment over and above that is necessary to provide one allotment for all producers in Class I would be allotted *pro rata* to Class II producers on a basis proportional to the average acreage certified for the past three years. It is expected that seed will be fully subscribed by Class I producers for most releases. If the available seed is not fully subscribed by Class I producers as outlined in the paragraph above, the Class II producers will be eligible for first allotments by chance if seed is limited. Finally if seed is available after allotment to Class II producers, single allotments by chance would be made to Class III producers. When the seed supply is not sufficient to meet the demand, first allotments to Class I producers will be determined by chance. The minimum allotment will normally be that sufficient to plant 10 acres of soybeans or small grains.

(4) *Qualification to receive a new release.*—(a) An individual may apply for seed of a new variety only under one name or as a member of one partnership or one corporation and have no financial interest in any other lot of seed of the new variety.

(b) A family operating as one unit is eligible for one allotment or additional allotments based on acreage.

(c) The individual, partnership or corporation must agree to apply for and complete certification of the new variety in Indiana. The seed grower is responsible for completion of certification whether or not the grain is transferred in bulk for completion of certification. Failure to complete certification of a new variety will result in a loss of this acreage from the three-year average acreage history. Failure to complete certification of the crop will result in the loss of Class I status for the grower for the crop involved if it occurs in more than once in three years.

(5) The Agricultural Experiment Station reserves the right to deny seed of a new varietal release to any person, partnership or corporation for such period as it deems advisable for (1) violation of a previous contract for the same crop, or (2) misrepresentation of facts or intentions on any crop.

(6) *Appeal.*—The Crops Distribution Review Committee will review all problem cases and advise the individuals concerned. Individuals upon request will have the opportunity to meet the Committee for further consideration of their cases.

(7) Applications for seed for a new winter small grain variety will ordinarily be mailed on or before 1st July and will have a return deadline of July postmark. Applications for seed of a new spring small grain variety will ordinarily be mailed on or before 1st January and will have a return deadline of a January postmark. Applications for seed of a Soybean variety will ordinarily be mailed on or before 1st February and will have a return deadline of a February postmark.

VI. The policy will become effective when approved by the Director of the Purdue Agricultural Experiment Station.

APPENDIX-V

STATE VARIETY RELEASE COMMITTEES

Serial No.	State	Name and composition	Functions and Procedure
1	A. P. ..	*State Seed Committee* 1. Director of Research, APAU—Chairman 2. Director of Extension, APAU—Member 3. Dean of Agriculture, APAU—Member 4. Joint Director of Agricultural Department—Member 5. Head, Agricultural Research Institute, Rajendranagar—Convener 6. Deputy Director (Seeds), Department of Agriculture—Member 7. Plant Pathologist, Rajendranagar, —Member 8. Agricultural Entomologist Rajendranagar—Member 9. Agricultural Chemist, Rajendranagar—Member 10. Head of Regional Research Centre or Co-ordinator of Project Development, Rajendranagar—Member 11. Breeder or Specialist concerned—Member 12. Seed Testing Officer, Hyderabad—Member	The function is to judge the merits and demerits of a variety from the point of view of yield, resistance to diseases and pests as well as economic superiority. After a new variety is recommended by the particular crop breeder, it is included in a district trial. If the performance is good in respect of yield, resistance to pests and diseases and is agronomically superior, the variety would be released after thorough discussion in the State Seed Committee
2	Bihar ..	*Agriculture Improvement Advisory Committee* 1. Director of Agriculture .. 2. Director of Agricultural Research 3. Director of Extension services 4. Deputy Director of Agriculture (Headquarters) 5. Range Deputy Director of Agriculture	The function is to discuss the results of varietal trials conducted in different regions in different years put up by crop specialists concerned with detailed data to enable the Committee to take decision The specialist of the Crop puts up the proposal to the Committee for release of a variety after conclusion of trial. The Committee examines the proposal and takes decision
3	Gujarat ..	*State Variety Release Committee* 1. Director of Agriculture—Charimar 2. Deputy Director of Agricultural Extension—Member 3. Deputy Director of Agricultural Research—Member 4. Crop Specialist—Member 5. Plant Pathologist—Member 6. Agricultural Entomologist—Member	The results of the new variety tested on cultivator's fields are presented to the Sub-Committee of the State Agricultural Research Committee, which, after examining the results, approves the release of the variety. This is then referred to the State Variety Release Committee which finally recommends release.

Serial No.	State	Name and composition	Functions and Procedures
		7. Agronomist— Member 8. Convener of Plant Breeding and Soil Science Sub-Committee—Member	
4	Haryana	*State Variety Release Committee* 1. Director of Agriculture 2. Representatives of the university	After the new varieties have passed through prescribed stages of trials, they are put up to the Variety Release Committee for decision. The Committee examines the proposals and takes decision suitably.
5	H. P.	.. *State Variety Release Committee* 1. Department of Agriculture .. 2. Horticulturist, Department of Agriculture 3. Deputy Director of Agricultural Extension 4. Deputy Director of Agricultural Research 5. Potato Development Officer	New varieties are scientifically assessed for their economic character for a period of at least 3-4 years and then released
6	Kerala	.. *State Variety Release Committee* 1. Additional Director of Agricultural Research 2. Additional Director of Agricultural Extension 3. Joint Director of Agric. Southern Region 4. Joint Director of Agric. Northern Region 5. Rice Specialist 6. Deputy Director of Agric. Seed Development	The function is to recommend release of varieties for the State. The new varieties evolved at the Agricultural Research Stations are tested under cultivators' field conditions and if the performance justifies release, they are put up to the State Variety Release Committee for taking a final decision
7	Maharashtra	.. State Department of Agriculture releases the varieties	New varieties are released by the State Department of Agriculture when approved by the Agricultural Research Committee. The Botany and Horticulture Sub-Committee recommends the varieties to the State Department in respect of horticultural crops.
8	Punjab	... *State Variety Release Committee* 1. Director of Agriculture—Chairman 2. Director of Extension Edu. (PAU)—Convenor 3. Director of Research 4. Prof. of Plant Breeding 5. Deputy Director of Agriculture (Seeds)	The functions are to review the results of the trials conducted by the Extension Education staff of the PAU and Extension staff of the Department of Agriculture on cultivators' fields and regional farms for bringing the strains on the approved list and then releasing them officially. The promising new crop strains are first tested in

S. No.	State	Name and Composition	Functions and Procedures
		6. Deputy Director of Agriculture of the region where the variety is to be introduced 7. Crop Breeder of the crop concerned	the final yield trials at the different research stations of the PAU. On the basis of the results obtained over a maximum period of three years or less depending upon the margin of superiority of the new strain over the existing varieties the Professor and Head of Plant Breeding, PAU, requests the Variety Evaluation Committee of the PAU to examine the performance of the new strains on farmers' fields. The strain is then tested on the cultivatios' fields by the Extension Education staff of the PAU. Simultaneously, the Extension staff of the Agriculture Department conduct trials at the regional farms and cultivators' fields for a maximum period of two years. The results of these trials are received by the Variety Release Committee for bringing the strains on the approved list and releasing the same officially.
9	U.P.	*State Variety Release Committee* 1. Economic Botanist (Rabi cereals) 2. Economic Botanist (Oilseeds) 3. Economic Botanist (Cotton) 4. Economic Botanist (Paddy) 5. Economic Botanist (Legumes 6. Deputy Director of— Agriculture —Co-opted Members 7. Regional Officers of Research Stations	The prescribed procedure for release of new varieties in the State is that the State Variety Release Committee reviews the performance of new varieties in the State twice a year viz. in May at the time of the meeting of the State Research Advisory Committee to consider and approve the research programmes for Kharif and in September when research programmes for Rabi crops are finalized. The Committee reviews the performance in relation to the already released varieties and if it is satisfied that the new variety has got the characters and potentialities distinct from the existing varieties, the new variety is released.

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APPENDIX—VI

Suggested policy for supply of breeding material

I. Public Breeding Material.—All seeds within all public breeding programmes should be made available upon a request basis to all public supported scientific institutions within and outside the country. Where restrictions have been placed upon seeds, the recipient, both within and outside the country, should be apprised of such a policy.

Requests from private organizations both within and outside the country should be handled in accordance with the following :

(*a*) *Breeding stocks being maintained without selection* :

Accessions.—The material which has been received from another station within the country or from stations outside the country would be freely available to private organizations unless the source country or station stipulates otherwise.

(*b*) *Other breeding stocks with commercial possibility* :

Genetic stock.—Genetic stock is valuable because it has some particular characteristics of importance which could be incorported into breeding stock. Such material should be freely available to private organizations both within and outside the country.

(*c*) *Breeding stocks for purposes of selecting new varieties* :

(i) *Crosses made for the purposes of extracting new lines.*—Only seed of F1 or F2 bulk would be available to private organizations. Once the line is released it would become available.

(ii) *Line selections from accessions.*—Once selection begins, availability to private organizations ceases until the line is released.

(*b*) *Combination of varieties* :

(i) *Composites.*—No availability of parents or the composites of the parents to private organizations during the development or propagation of composites prior to their release. Upon release of the composite, it and the parents will become available to private organizations.

(ii) *Hybrids.*—No availability of the parents to private organizations until released for commercial cropping. Hybrid combinations could be freely available either for testing or for making crosses from which new lines could be extracted. Upon release of the hybrid, the parents would also be released and would be available to private organizations.

II. Private Breeding Material.—(a) Organizations doing private breeding should be free to import small quantities of many lines and experimental material from other private organizations and scientific institutes. Of course, the normal procedures regarding plant quarantine would need to be met.

(b) Private organizations should not be expected to divulge detailed information regarding the pedigree of material they develop. This degree of protection is needed if they are to support their research through their exclusive sales of improved hybrids.

(c) Private breeders and organizations, however, should give due credit and recognition for breeding material they have obtained and utilized from the public programmes.

APPENDIX-VII

A suggested scheme for an independent seed certification agency

Seed certification agencies established by the states shall have as their objective the maintenance and multiplication of high quality seeds of superior varieties of crops so grown and distributed as to insure genetic identity and purity.

The certification agency established under the Act should preferably be an incorporated body as a non-profit organization whose principal objective is to conduct seed certification.

The agency would not be engaged in the production, processing or the distribution of seeds ; though the seed certification committee, which shall be the governing body of the seed certification agency may be composed in part of persons engaged in such processing and distribution of seeds.

Members of the Seed Certification Committee of a State may be appointed by the State Government and could be composed of persons in the following categories :—

No. of Representatives	*Interests Represented*
2	Plant Breeders
1	Plant Pathologist
2	Certified Seed Producers
2	Seed Dealers of Certified Seeds
1	Representative of the Secretary of Agriculture
1	Agricultural Extension Service
1	Agricultural University
1	Deputy Director of Agriculture (Seeds)
1 (*ex officio*)	The Seed Certification Officer of the State
1 (*ex officio*)	The Chief Seed Analyst of the State
1 (*ex officio*)	Chief Seed Inspector
1 (*ex officio*)	Liaison Representative of the Central Government

The State Seed Certification Officer shall serve as Secretary of the Committee.

Persons appointed to the Seed Certification Committee (other than those serving in an *ex officio* capacity) by the State government as provided herein shall, at the outset be appointed for either one year or two year terms in such a manner that persons representing special interests shall serve staggered terms. Thereafter appointment should be for two year terms so as to provide continuity of membership to the Committee.

At such time as an organization of certified seed producers attains a paid-up membership of 25 or more bonafide members, the organization of certified seed producers may be allowed to nominate three of their members for appointment to the Committee.

Like-wise, at such time as an organization of seed dealers who distribute certified seeds attains a paid-up membership of 25 or more bonafide members, the said organization of certified seed dealers may be allowed to nominate three of their members for appointment to the Committee. Final selection in both cases would rest with the Government.

Fees collected for inspections would be placed in a revolving fund under the control of the certifying agency and be expended by the certification committee on proper vouchers in meeting all necessary expenses including salaries of necessary staff, procurement of necessary vehicles, equipment and supplies, paying for office space, paying necessary travel expenses of officers, inspectors and committee members and expenses of publications. An annual report including accounts should be submitted to the Government.

Functions of the Seed Certification Agency:

The function of the Certification Agency would include:

(1) Verification of the varietal purity and identity of seeds of varieties released for certification in notified areas and verification that the certified seed producer received and planted such seed under prescribed conditions.

(2) Outline procedures for the production, harvesting, processing, storage and labelling of seeds intended for certification to the end that seed lots finally approved for certification are true to variety and meet prescribed minimum standards for certification. Provide applications and other necessary forms together with information on standards and procedures for certification to all persons having the requisite qualifications and showing interest in certified seed production. Upon receipt of an application for certification from a person verify that the variety is eligible for certification, that the seed source used for planting was authenticated by certification tags and records of purchase in accordance with rules prescribed and that the prescribed fees were submitted with the application.

(3) Inspect fields to assure that the prescribed minimum standards for isolation, planting ratio, rouging (where applicable) use of male sterility (where applicable) and similar factors are maintained at all times as well as to ensure that seed-borne diseases are not present in the field to a greater extent than those provided in the prescribed standards for individual crops. The presence and rate of occurrence of prohibited, restricted, and other objectionable weed seeds shall appear in the field inspection report.

(4) Sample and inspect seed lots produced under the procedures prescribed by the certification agency and submit such samples to the state seed laboratory for testing to ensure that the seed meets prescribed seed quality standards.

(5) Inspect seed processing plants to see that admixtures of other kinds and varieties are not introduced, that the processing is conducted in such a way as not to injure the seed, and that such processing results in high quality seeds as prescribed in the standards.

(6) To develop a list of seed processing plants with personnel and equipment capable of meeting the objectives stated in paragraph 5 above and designate such processing plants as "approved processing plants" for processing certified seeds ; to provide a suitable emblem to identify such approved processing plants ; to withdraw approval and the emblem if the precessing plant fails to maintain prescribed standards for such plants.

(7) In consultation with the Central Seed Committee develop the form of a certification tag or tags as defined in these rules to be used for identifying the various lots and generations of certified seed defined in the Seeds Act rules and issue such tags as prescribed.

(8) Assure that the field inspections required to maintain the purity of the variety are thorough and timely ; that inspections of seed lots produced under the supervision of the seed certification agency are timely, that seed samples are promptly submitted to the seed analyst having jurisdiction and that certification, tags, labels and seals are issued expeditiously to the end that orderly marketing of the seed is made possible.

(9) Carry out educational programmes designed to promote the use of the seed certified including a publication listing certified seed growers and sources of certified seed.

(10) Charge such fees as may be necessary to meet all costs incurred in carrying out the duties and responsibilities of the certification agency after a preliminary grant is made by the State Government to start the programme.

(11) Employ such staff as is necessary to carry out the prescribed functions including ;—

(a) A Seed Certification Officer.
(b) Seed Certification Inspectors as needed.
(c) An adequate clerical staff.

Acquire office and storage space, together with necessary equipment and supplies and acquire the forms necessary for expeditiously carrying out the programme.

(12) Make provisions for the travel necessary to provide the timely field inspections and seed inspections prescribed.

(13) Operate through a seed certification committee which shall be the governing body of the seed certifying agency and which shall represent official, technical, seed producer and seed dealer interests. The committee shall elect officers, adopt bye-laws and may appoint such sub-committees as may be necessary to give attention to problems relating to specific crops and to other specific problems as they arise.

(14) Adhere to minmum standards for certification prescribed by the Central Government on the advice of the Central Seed Committee.

(15) Operate in such a way as to ensure a close working relationship between certified seed growers, certified seed dealers, agronomy research personnel, agricultural universities, and State Departments of Agriculture, together with seed analysts and seed inspectors appointed under the Act.

(16) Maintain such records as may be necessary to verify that seed sown for the production of certified seed is eligible for such sowing under these rules.

(17) Set up procedures for handling appeals as provided in section 11 of the Seeds Act.

(18) Vigorously investigate violations and apparent violations of the Seeds Act as it pertains to certified seed and take appropriate action including the invocation of section 10 of the Act wherever applicable. Use of the words "Foundation", "Registered" or "Certified" in connection with seed that has not been certified as prescribed would be an offence and a violation of the Act. Likewise, attachment of certification tags to seed that is not a certified seed as defined shall be an offence and a violation of the Act.

(20) Outline the duties of seed certification officers, inspectors and other personnel employed by the agency.

APPENDIX—VIII

MINIMUM SEED CERTIFICATION STANDARDS

Abbreviations used in this Appendix are explained below :—

(1) N.S.C.	.. National Seeds Corporation Ltd., India.
(2) I.C.I.A. 1	.. International Crop Improvement Association, U.S.A.
(3) I.C.I.A. 2	.. Illinois Crop Improvement Association, Illinois (U.S.A.)
(4) M.S.I.A.	.. Mississippi Seed Improvement Association, Mississippi (U.S.A).
(5) C.C.I.A.	.. California Crop Improvement Association, California (U.S.A.)
(6) P.D.A. & F.	.. Provincial Department of Agriculture and Forestry, Taiwan.
(7) P.A.U.E.S.	.. Purdue Agricultural University Experiment Station, Indiana (U.S.A.)
(8) F.	.. Foundation.
(9) R.	.. Registered.
(10) C.	.. Certified.
(11) *.	.. No standard has been prescribed.
(12) (–)	.. When sowing was done by plane with rows parallel to the contaminant plot.
(13) (+)	.. When rows are not parallel.
(14) @	.. Certified seed class—Green tag.
(15) (—) or	.. Certified seed class—blue tag.
(16) Plt	.. Plant.
(17) var.	.. Variety.
(18) ac	.. Acre.
(19) hds.	.. heads.
(20) R.S.	.. Receptive silks

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MINIMUM SEED CERTIFICATION STANDARD
WHEAT

Serial No.	Factor		N. S. C.	I.C.I.A.(1)	I.C.I.A. (2)	M.S.I.A.	C.C.I.A.	P.A.U.E.S.	P.D.A. & F.
A.	Field Standards—								
	(i) Isolation distance		3-4 meters	*	From other varieties One rod and 40 rods from rye for early varieties	Twelve feet	Ten feet	Ten feet from other varieties 5 feet from other crops and 20 rods from rye	Three meters
	(ii) Other varieties (Def. off-types)	F	1/1000 or (0.10%)	1 : 3000 Plts (heads)	1 : 5000 (0.02%)	None	1/10000 heads	1 : 3300 heads (0.03%)	None
		R	3/1000 (0.30%)	1 : 2000 Plts heads	1: : 5000 (0.02%)	10 plants/acre	1/10000 heads	1:2000 heads (0.05)	0.20%
		C	5/1000 (0.50%)	1:1000 Plts	1:1000 (0.10%)	@ 30 Pts./ac 30 Pts./ac	1 head/Sq.rod	1:1000 heads (0.10%)	0.50%
	(iii) Other crops (in-sparable)	F	1/10000 (0.01%)	1:10000 Plts (hds)	1:10000 (0.01%)	None	1/10000 heads	1 plt/acre	*
		R	1/10000 (0.01%)	1 : 10000 Plts (hds.)	1 :10000 (0.01%)	10 Plts/ac.	1/10000 heads	5 plts/acre	
		C	1/2000 (0.5%)	1 : 2000 Plts (hds)	1 : 5000 (0.02%)	@ 30 Pts./ac. 30 pts/ac.	1 head/Sq.rod	5 plts/acre	
	(iv) Noxious weeds	F	None	None	None	None	None	0.2 plt/acre	
		R	None	None	None	None	None	1 plt/acre	
		C	None	None	None	@ 5 plt/ac. @ 5 plt/ac.	None	5 plt/acre	
	(v) Diseases : Loosesmut	F	1/1000 (0.1%)		0.01%	1.00%	5 plts/acre	1 : 500 hds (0.20%)	
		R	1/1000 (0.1%)	*	0.10%	1.00%	5 plts/acre	1 : 200 hds (0.50%)	
		C	1/1000 (0.1 %)		1.00%	@ 1.00% 1.00%	1 ptl/5 sq.road	1 : 100 hds (1.00%)	
B.	Seed Standards:								
	(i) Pure Seed	F	99%	*	*	98%	99%	99%	99%
		R	98%	96%	98%	98%	99%	99%	99%
		C	98%	96%	98%	@98%	99%	99%	99%
	(ii) Other varieties	F	None	1 seed/lb	1 seed/lb	None	1 seed/lb	0.03%	None
		R	1 seed/ 500 gms	1 seed/lb	1 seed/lb	None	1 seed /lb	0.05%	None
		C	10 seeds/ 500 gms	10 seeds/lb	10 seeds/lb	@ 9 seed/lb 9 seed /lb	1 seed/lb	0.10%	None
	(iii) Other crops	F	1 seed/ 500 gms	1 seed/lb	1 seed/lb	None	1 seed /lb	1 seed/lb and No rye	None
		R	2 seeds/ 500 gms	2 seeds/lb	1 seed/lb	None	2 seeds/lb	2 seeds/lb and No rye	None
		C	10 seeds/ 500 gms	5 seeds/lb	2 seeds/lb	@ 9/lb 12 /lb	2 seed/lb	5 seed/lb and 1 rye/5 lb	None
	(iv) Inert matter	F	1%	*	*	2%	1.0%	1.0%	0.3%
		R	2%	4%	2% (1½ % broken —½% others)	2%	1.0%	1.0%	0.5%
		C	2%	4%	2% Ditto	@ 2% & 2%	1.0%	1.0%	1.0%

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Serial No.	Factor		N. S. C.	I.C.I.A.(1)	I.C.I.A. (2)	M.S.I-A.	C-C.I.A.	P.A.U.E.S.	P.D.A. & F.
(v)	Noxious weeds	F	None	None	None	None	None	None	None
		R	None	None	None	None	None	None	None
		C	None	None	None	None	None	None	0.10%
(vi)	Germination	F	85%	* *	*	85%	90%	*	90%
		R	85%	85%	90%	85%	90%	85%	85%
		C	85%	85%	90%	@85%	90%	85%	80%
(vii)	Weed seeds	F			10 seeds/lb	None	0.1%	5/lb (All except Cheat)	
		R	*	*	10 seeds/lb	None	0.1%	10/lb	
		C			10 seeds/lb	@ 5 lb & 9lb	0.1%	15/lb	
(viii)	Moisture	F	12%					14%	12%
		R	12%	*	*	*	*	14%	12%
		C	12%					14%	12%

PADDY

Serial No.	Factor		N. S. C.	I.C.I.A.(1)	M.S.I.A.	C.C.I.A.	P.D.A. & F.
A.	**Field Standards—**						
	(i) Isolation		3 meters	100(—)¼(—)	100¼ mile(×)	100(—)¼ miles(×)	3 meters
	(ii) Definite offtypes	F	1/1000 heads (0.1%)	None	None	None	None
		R	3/1000 heads (0.3%)	None	None	None	None
		C	5/1000 heads (0.5%)	1 plt/Sq rod	@ 10 plts/ac. $100 plts/ac	1 head/Sq. rod	None
	(iii) Red rice (inseparable other crops)	F	None	None	None	None	*
		R	None	None	None	None	*
		C	None	1 plt/20 sq. rod	@ None $5 plts/ac	None	
	(iv) Objectionable weeds	F	None	None	None	None	None
		R	None	None	None	None	None
		C	None	None	None	None	10 plts/t 0.1 hecare
	(v) Seed-borne diseases	F	None	None	None	*	None
		R	None	None	None	*	None
		C	None	None	None	*	None
B.	**Seed Standards**						
	(i) Pure Seed	F	98%	98%	98%	99%	99 .5%
		R	98%	98%	98%	99%	99%
		C	98%	98%	@ 98%	99%	98.5%
	(ii) Other crops and other vars	F	1 seed/40 gms	None	None	None Other crops	Non Other Crops
		R	1 seed/40 gms	@ None	@ None	None	None Othe varieties
		C	2 seeds/40 gms	0.02%	@ 5/lb $9/lb	2 seeds/lb	20/kg
			ds 01, other crops	0.01 other varieties	other crops 5/lb & 9/lb other vars	and other varieties	
	(iii) Inert Matter	F	2%	2%	2%	1%	0.5%
		R	2%	2%	2%	1%	1.0%
		C	2%	2%	at 2% $2%	1%	1.5%
	(iv) Total weed seeds	F	4/40gms	0.05 %	None	0.05%	None
		R	8/40 gms	0.05%	None	0.05 %	None
		C	8/40 gms	0.10%	@ 5/lb $18/lb	0.10 %	5/Kg.
	(v) Objectionable weeds	F	1/40 gms	None	None	None	
		R	1/40 gms	None	None	None	
		C	2/40 gms	None	None	None	
	(vi) Germination	F	85% 80%	80%	80%	85%	90%(1) 90%(2) 90%(3)
		R	85%, 80 %	80%	80%	85%	85%, 85% 85%
		C	85%, 80%	80%	80%	85%	80%, 80% 80%
	(vii) Moisture		14 %	14%	14%	*	13%

SORGHUM (HYBRID)

Serial No.	Factor		N.S.C.	I.C.I.A. (1)	I.C.I.A.(2)
A.	Field Standards—				
	(i) Isolation	F	300 meters from grain and dual purpose sorghum 400 meters from forage sorghum 400 meters from forage grass	60 rods	60 rods
		C	200 meters from grain sorghum 200 (or) 400 meters from forage sorghum, 400 meters from Johnson grass, 400 meters from grassy highly tillering sorghum	400 rods from other vars. 60 rods from any forage vars. 80 rods from grass sorghum or broomcorn	40 rods from any other vars. 60 rods from any forage vars. 80 rods from grass forghum and broomcorn
	(ii) Pollen shedders in female parent	F	1/2000 or (0.05%)		
		C	5/4000 or (0.125%)	1/2000 (0.05%)	1/200 (0.05%)
	(iii) Definite off-types	F	1/20000 (0.005%)	0.005 %—Blooming None—Final	None
		C	1/5000 (0.02%)	1/20000(0.005%)	1/20000 (0.005)%
	(iv) Doubtful off-types	F	1/5000 (0.02%)	0.01 %—Blooming None—Final	None
		C	1/1000(0.1%)	1/1000 (0.1%)	1/1000 (0.1%)
	(v) Objectionable weeds	F	None	None	None
		C	None	None	None
	(vi) Head smut	F	1/20000	..	None
		C	1/10000	..	1/10000(0.01%)
	(vii) Kernel smut	F	1/5000	None	None
		C	1/2,500	1/2500 (0.04%)	1/2500 (0.04%)
B.	Seed standards—				
	(i) Pure seed	F	97%	98%	98%
		C	97%	98%	98%
	(ii) Other vars	F	0.005%	None	None but not more than 2/lb
		C	0.05%	0.01%	0.01%
	(iii) Other crops	F	0.005%	0.01%	0.01% but not more than 10/ lb
		C	0.03%	0.08%	0.07%
	(iv) Objectionable weeds	F	None	None	None
		C	None	None	None
	(v) Total weeds	F	0.10 %	0.10%	0.10%
		C	0.10%	0.10%	0.10%
	(vi) Inert matter	F	3%	2%	2%
		C	3%	2%	2%
	(vii) Germination	F		80%	80%
		C	80%	80%	80%
	(viii) Moisture	F	12%	*	*
		C	12%	*	*

MAIZE

No.	Factor	N.S.C.	I.C.I.A.(1)	M.S.I.A.	P.A.U.E.S.	P.D.A. & F.
			INBRED LINES			
(A)	Field standards—					
	(i) Isolation	400 meters	40 rods	660 feet	40 rods for Corn with same grain colour, 80 rods for corn with other colour, sweet, pop, corn	No isolation is needed
	(ii) Def. off types	0.1 % with 5% receiptive silks	0.1% with 5% receptive silks	0.1% with 5% recept've silks	0.1%	0.1% with 5% receptive silks
	(iii) Doubtful of ftype	2.0 % with 5 % R.S.	2.0% with 5% R.S.	2.0 % with 5% R.S.	*	2.0 % with 5% R.S.
(B)	Seed standards—					
	(i) Definite off type ears	0.1%	0.1%	0.1%	0.1%	0.%
	(ii) Ears with off coloured kernels	0.2%	0.2%	0.8%	*	0.2%
	(iii) Pure seed	98.80%	*	*	*	*
	(iv) Other vars and other crop seeds	0.2%	*	*	*	*
	(v) Inert matter	1%	*	*	*	*
	(vi) Weed seeds	None	*	*	*	*
	(vii) Moisture	12%	*	*	*	*
			SINGLE CROSS			
(A)	Field standards					
	(i) Isolation	400 meters	40 rods	660 feet	40 rods from other corns with same colour and 80 rods from corn with other colour	300 meters
	(ii) Shedding tassels in female parent	0.50% at any one inspection or 1.0% as total of 3 inspections with 5% R.S.	1.0% at any one inspection or 2% as total of three inspections with 5% R.S.	1 % at any one inspection or 2% as total of three inspections with 5% R.S.	0.5% at any one inspection or 0.75% as total of three inspections with 5% R.S.	1% at any one inspection or 2.5 % as total of three inspections with 5% R.S.
	(iii) Definite off types in male parent	0.1%	0.1%	0.1%	0.1%	0.1 % with 5% R.S.
	(iv) Doubtful off type in male parent	2%	*	2%	*	2% with 5% R.S.
	(v) Definite off type in female parent at last inspection	0.1%	0.1%	0.1%	0.1%	*
	(vi) Doubtful off types in female parent at last inspection	2%	*	2%	*	*
(B)	Seed standards—					
	(i) Def. off type ears	0.1%	0.1%	0.1%	0.1%	0.2%
	(ii) Off coloured kernels	0.2%	0 .2 %	0.2%	*	0.2%
	(iii) Pure seed	98.8%	*	*	*	*
	(iv) Other crop seed and other vars	0.2%	*	*	*	*
	(v) Inert matter	1%	*	*	*	*
	(vi) Weed seed	None	*	*	*	*
	(vii) Moisture content	12%	*	*	*	*

MAIZE DOUBLE CROSS

Serial No.	Factors	N.S.C.	I.C.I.A.(1)	I.C.I.A.(2)	M.S.I.A.	P.A.U.E.S.	D.A.A.& F.
A.	Field Standards						
	(i) Isolation	200 meters	40 rods	40 rods	660 feet	40 rods	300 meters
	(ii) Shedding tassels in female parent	1% at any one inspection or 2% as total of 3 inspections with 5% R.S.	1% at any one inspection or 2% as total of 3 inspections with 5% R.S.	1 % at any one inspection or 2% as total of 3 inspections with 5%R.S.	1% at any one inspection or 2% as total of 3 inspections with 5% R.S.	1% at any one inspection or 2% as total of 3 inspections with 3% R.S.	1% at any one inspection or 2.5 as total of 3 inspections with 5% R.S.
	(iii) Definite off-type in male parent	0.2%	*	*	1%	1 % at any one inspection or 2 %as total of in inspections with 3% R.S. female rows	*
	(iv) Doubtful offtype in male parent	2%	*	*	*	*	*
	(v) Definite off-type in female parent	0.2% at last inspection	*	*	1%	20% at last inspection	0.2%
	(vi) Doubtfull off types in female parent	2.0% at last inspection	*	*	*	*	*
B.	Seed Standards						
	(i) Pure Seed	98.8 %	98.0%	98.0%	98.0%	99.0%	97%
	(ii) Other crops and other vars	0.20 %	0.50%	0.50%	0.50% other varieties) None (other crops)	0.50% (other varieties) 2/lb (other crops)	0.2% other vrieties
	(iii) Weed seeds	None	None	None	None	None	None
	(iv) Inertmatter	1.0 %	2.0%	2.0%	1.0%	1.0%	2.0%
	(v) Germination	90.00%	90.00%	90.00%	90%	90.00 %	85.00%

SOYBEANS

Serial No.	Factor	N.S.C.	I.C.I.A.(1)	I.C.I.A.(2)	M.S.I.A.	P.A.U.E.S.	P.D.A.& F.
A.	Field Standards						
	(i) Isolation	25 feet	5 feet	One rod	15 feet (when rows are parallel) and 30 feet (otherwise)	6 feet	2 to 6 meters
	(ii) Other varieties	F 10%	0.10%	0,10%	None	0.10% (1/1000)	None
		R 20%	0,20%	0.20%	None	0.20% (2/1000)	0,20%
		C 50%	0,50%	0,50%	at 10 plts/ac 5 plts/a	0.50 (5/1000)	0.5%

Serial No.	Factor		N.S.C.	I.C.I..A.(1)	I.C.I.R.(2)	M.S.I.A.	P.A.U.E.S.	P.D.A. &. F.
(iii)	Corn & /or sun-flower plants bearing seed	F	None	None	None	None	None	None
		R	None	None	None	None	None	None
		C	2 plts/acre	2 plts/acre (only corn)	None	at 3 plts/ac.	None (oly corn 0.5 plts a/ac	
(iv)	Objectiona-able weeds	F	None	None	None	None		*
		R	None	None	None	None		
		C	None	None	None	None		
	Seed Standards							
(i)	Pure seed	F	*	*	*	97 %	98%	99%
		R	97%	98%	98%	97%	98%	98%
		C	97%	98%	98%	98% 097%	98%	98%
(ii)	Other crops	F	3 seeds/lb	3/ob Excluding corn and sunflower	1/b including corn and sunflower	None	1/lb Ex lucorn	None
		R	3 seeds/lb	3/lb	2/lb	None	2/lb	None
		C	3 seeds /lb (exluding corn and sunflower)	3/lb	3/lb	at 1/lb & 9/lb	3/lb	None
(iii)	Corn and sun-flower	F	*	*	*	*	None	*
		R	None	None	None	*	None	*
		C	1 seed/lb	1 seed /lb			1 seed/5lb (only corn)	
(iv)	Other varie-ties	F	0.10lb	0.10%	0.10%	None	0.10%	None
		R	0.20%	0.20%	0.20%	None	0.20%	10/kg
		C	0.50%	0,30%	0.30%50%	at 5/lb 09/lb	0.5%	20/1g
(v)	Inert matter	F	*	*	*	3%	2.0%	1%
		R	3.0%	2,0%	2,0%	3%	2.0%	2
		C	3.0%	2·0%	2,0%	at 3 % 03%	2.0	2
(vi)	Total weed	F	10/1	0,05 %	5/lb	None	2/lb	None
		R	10/lb	0.05 %	7/lb	None	3/lb	None
		C	10/lb		10/lb	at 1/lb 02/lb	4/lb	None
(vii)	Objec-tionable weeds	F	None	None	None	None	None	None
		R	None	None	None	None	None	None
		M	None	None	None	None	None	None
(viii)	Germina-tion	F	*	*	*	80%	*	85%
		R	80%	80%	80%	80%	80%	80%
		C	80%	80%	80%	80%	80%	80%
(ix)	Moisture	F	14%	14%	*	13%	14%	12%
		R	14%	74%		13%	14%	12%
		C	14%	14%		13%	14%	12%

GROUNDNUT (PEA NUT)

Serial No.	Fector		N.S.C.	I.C.I.A.(1)	P.D.A. & E.
A.	**Field standards**				
	(i) Isolation		Three to four meters	Ten feet	Two meters
	(ii) Other vars	F	None	None	None
		R	2 plants/1000 (0.2%)	0.20%	0.20%
		C	5 plants/1000 (0.5%)	0.50%	0.5%
	(iii) Objectionable weeds	F	None	None	*
		R	None	None	*
		C	None	None	*
	(iv) Diseases (Sclerotium wilt)	F	*	*	None
		R	*	*	0.2%
		C	*	*	0.5%
B.	**Seed standards**				
	(i) Pure seed	F	99%	*	99%
		R	99%	97%	98%
		C	98%	97%	98%
	(ii) Other varieties	F	None	None	None
		R	0.20%	0.20%	None
		C	0.50%	0.50%	None
	(iii) Other crops	F	None	None	None
		R	2 seeds/lb	0.01	None
		C	8 seeds/lb	0.02	None
	(iv) Inert matter	F	1%	*	1%
		R	1%	3%	2%
		C	2%	3%	2%
	(v) Objectionable weeds	F	None	None	None
		R	None	None	None
		C	None	None	None
	(vi) Total weed seeds	F	5 seeds/16	0.01%	None
		R	5 seeds/16	0.01%	None
		C	5 seeds /16	0.01%	None
	(vii) Germination	F	80%	75%	85%
		R	80%	75%	80%
		C	80%	75%	80%
	(viii) Moisture		5%	..	13%

COTTON

Serial No.	Factor	N.S.C.	I.C.I.A.(1)	M.S.I.A.	C.C.I.A.	P.D.A.F.
A.	**Field standards**					
	(1) Isolation	.. 100 meters	(i) upland 100 ft. (ii) Egyptian 440 yards for F & R and 220 yeards for 'C'	50 ft. (unless varieties adjacent were planted with certified seed of the same variety)	R(i) 1/2 mile from any other varieties of similar type (ii) 1 mije from Egyptian or other widely different C. (i) 1/4 mile from similar varieties (ii) 1 mile from widely different varieties	400 meters
	(2) Other varieties definite and doubtfull off type plants :	F None	None	None	*	None
		R 1/15000 plants (0.008%)	1 plant/acre	1 Plant/acre	1 plant/acre	None
		C 5/15000 plants (0.03%)	5 plants/acre	5 plants/acre	5 plants/acre	1 plant/0.1 hectare
	3. Objectionable weeds	F R C The kind and amount will be determined by the N.S.C. in due course	The kind and amount as determined by the certifying agency	*	None None None	*
	Seed standard					
	(1) Pure seed	F 98%	98%	99%	99%	99%
		R 98%	98%	99%	99%	99%
		C 98%	98%	99%	99%	98%
	(2) Total other crop seeds including other varieties	F None	None	None	None	None
		R None	None	None	None	None
		C None	None	None	None	None
	(3) Total weed seeds	F None	None	1/2lb.	None	None
		R None	0.10%	1/2lb	None	None
		C None	0.02%	1/2 lb	None	2 seed/kg
	(4) Total inert matter	.. F 2%	2%	1%	1%	1%
		R 2%	2%	1%	1%	1%
		C 2%	2%	1%	1%	2%
	(5) Germination	..F 70%	80%	80%	80%	80%
		R 70 %	80%	80%	80%	80%
		C 70%	80%	80%	80%	80%
	(6) Moisture	.. F 10%	*	*	*	10%
		R 10%	*	*	*	10%
		C 10%	*	*	*	10%

*Objectionable weed seeds—None in all the three classes..

LUCERNE

No.	Factor		N.S.C.		I.C.I.A.I.		P.A.U.E.S.	
(A)	Field Standards :		*Less than 5 acres*	*More than 5 acres*	*Less than 5 acres*	*More than 5 acres*	*Less than 5 acres*	*More than 5 acres*
	(i) Isolation		Meters	Meters	rods	rods	rods	rods
		F	400	400	80	80	80	80
		R	200	200	40	20	40	20
		C	100	100	20	10	20	10
			(100 meters between different classes of the same variety except the certified seed class)		(10 rods between different classes of the same variety except the certified seed class)		(10 rods between different classes of the same variety)	
	(ii) Other varieties	F	0·20%		0·20%		0·20%	
		R	0·50%		0·50%		0·50%	
		C	1·00%		1·00%		1·00%	
	(iii) Sweet clover	F	None		None		None	
		R	10 plants/acre		10 plants/acre		10 plants/acre	
		C	160 plants/acre		160 plants/acre		160 plants/acre	
(B)	Seed Standards :							
	(i) Pure Seed	F	99%		99%		99%	
		R	99%		99%		99%	
		C	99%		99%		99%	
	(ii) Sweet clover	F	9/lb.				9/lb.	
		R	90/lb.		*		90/lb.	
		C	180/lb.				180/lb.	
	(iii) Other crops	F	0·10%		0·10%		0·10%	
		R	0·10%		0·10%		0·10%	
		C	0·50%		0·50%		0·25%	
	(iv) Weed seeds	F	0·10%		0·10%		0·10%	
		R	0·20%		0·20%		0·15%	
		C	0·50%		0·50%		0·25%	
	(v) Objectionable weeds	F	None		None		None	
		R	None		None		None	
		C	None		None		None	
	(vi) Inert matter	F	1·0%		1·0%		1·0%	
		R	1·0%		1·0%		1·0%	
		C	1·0%		1·0%		1·0%	
	(vii) Germination	F	80%		80%		80%	
		R	80%		80%		85%	
		C	80%		80%		85%	

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OKRA (BHINDI)

No.	Factor		N.S.C.	I.C.IA.I.
(A)	Field Standards :			
	(i) Isolation	F	800 meters	80 rods
		R	*	80 rods
		C	400 meters	50 rods
	(ii) Definite off-types	F	0·10%	None
		R	*	5 plants/acre
		C	0·20%	10 plants/acre
	(iii) Undesirable and doubtful off-types	F	0·10%	None
		R	*	15 plants/acre
		C	0·30%	25 plants/acre
	(iv) Objectionable weeds	F	Nil	None
		R	*	None
		C	Nil	None
	(v) Other crops	F	Nil	*
		R	*	*
		C	Nil	
	(vi) Diseases	F	0·10%	
		R	*	*
		C	1·00%	

OKRA (BHINDI)—*concld*

No.	Factor		N.S.C.	I.C.I.A.I.
(B)	Seed standards :			
	(i) Pure seed	F	99%	*
		R	*	98%
		C	99%	98%
	(ii) Inert matter	F	1·0%	*
		R	*	2%
		C	1·0%	2%
	(iii) Weed seeds	F	Nil	0·05%
		R	*	0·05%
		C	Nil	0·10%
	(iv) Objectionable weeds	F	*	None
		R	*	None
		C	*	None
	(v) Other crop seeds	F	0·05%	None
		R	*	0·21%
		C	1·0%	0·52%
	(vi) Other kinds	F	*	None
		R	*	0·01%
		C	*	0·02%
	(vii) Other varieties	F	*	None
		R	*	0·20%
		C	*	0·50%
	(viii) Germination	F	70%	*
		R	*	65%
		C	70%	65%

PEAS

No.	Factor		N.S.C.	I.C.I.A.I.	P.D.A.&F.
(A)	Field standards :				
	(i) Isolation	F	50 meters	10 feet	5 meters
		R	*	10 feet	5 meters
		C	50 meters	10 feet	3 meters (includes other crops too)
	(ii) Definite off-types	F	0·10%	*	None
		R	*	0·02%	0·20%
		C	1·00%	0·10%	0·40%
	(iii) Other crops	F	Nil	*	
		R	*	0·02%	*See* (*ii*) above
		C	0·1%	0·10%	
	(iv) Undesirable and approximate off-types	F	Nil		
		R	*	*	*
		C	0·20%		
	(v) Objectionable weeds	F	Nil	None	
		R	*	None	*
		C	Nil	None	
	(vi) Diseases	F	0·50%		Trace
		R	*	*	0·20%
		C	1·00%		0·50%
(B)	Seed standards :				
	(i) Pure seed	F	98%	98%	99·2%
		R	*	98%	98·9%
		C	97%	98%	98·7%
	(ii) Inert matter	F	2%	2%	0·3 %
		R	*	2%	0·4%
		C	2%	2%	0·4%

PEAS—*concld*

No.	Factor		N.S.C.	I.C.I.A.I.	P.D.A.&F.
	(iii) Total other crop seeds including other varieties	F	0·10%	0·25%	0·20%
		R	*	0·50%	0·20%
		C	1·00%	1·0%	0·40%
	(iv) Total weed seeds	F	0·10%	0·25%	0·3%
		R	*	0·25%	0·4 %
		C	0·10%	0·25%	0·4%
	(v) Objectionable weeds	F		None	
		R		None	*
		C	*	None	
	(vi) Germination	F	75%	80%	85%
		R	*	80%	80%
		C	75%	80%	75%

TOMATO

Mo.	Factor		N.S.C.	I.C.IA.I.	P.A.U.E.S.	P.D.A.&F.
(A)	Field Standards—					
	(i) Isolation	F	50 meters	200 feet	200 feet	100 meters
		R	*	100 feet	*	50 meters
		C	50 meters	30 feet	30 feet	20 meters
	(ii) Definite off-types	F	0.10%	None		Trace
		R	*	1 in 300 plts.	*	0.20%
		C	0.40%	2 in 300 plts.		0.50%
	(iii) Undesirable approximate off-types	F	0.20%			
		R	*	*	*	*
		C	2.0%			
	(iv) Total off-types plants	F		None	None	
		R	*	1.0%	*	*
		C		2.0%	2.0%	
	(v) Other crops	F	Nil			
		R	*	*	*	*
		C	Nil			
	(vi) Objectionable weeds	F	Nil			
		R	*	*	*	*
		C	Nil			
	(vii) Diseased plants	F	Nil	To be specified by certifying agency	Bacterial canker	Bacterial spot
		R	*		None	Appropriate seed treatment required
		C	Nil		Trace	
						Trace 0.20% 0.50%
(B)	Seed Standards :					
	(i) Pure seed	F	98%	*	98%	99.5%
		R	*	98.0%	*	99.3%
		C	98%	98.0%	98%	97.9%
	(ii) Inert matter	F	2.0%	*	2%	0.50%
		R	*	2%	*	0.50%
		C	2.2%	2%	2%	1.50%
	(iii) Weed seeds	F	Nil	None	None	None
		R	*	None	*	None
		C	Nil	None	None	0.10%
	(iv) Objectionable weeds	F	*	None		
		R	*	None	*	*
		C	*	None		
	(v) Other crops	F	0.05%	None	None	(Includes other non-varieties)
		R	*	None	*	
		C	0.10%	0.20%	None	0.20% 0.50%

Tomato : *concld—*

No.	Factor		N.S.C.	I.C.I.A.I.	P.A.U.E.S.	P.D.A.&F.
(vii)	Other kinds	F	*	None	*	*
		R	*	None		
		C	*	0.10%		
(viii)	Other varieties	F	*	None	*	*
		R	*	None		
		C	*	0.10%		
(ix)	Germination	F	70%	*	75%	85%
		R	*	75%	*	80%
		C	70%	75%	75%	75%
(ix)	Moisture	F	*	*	*	11%
		R	*	*	*	12%
		C	*	*	*	12%

APPENDIX—IX

ELIGIBILITY REQUIREMENTS FOR CERTIFICATION OF CROP VARIETIES

Only those varieties that are accepted by the certifying agency as meriting certification, in accordance with the criteria listed below shall be eligible for certification. For those crops where certified review boards do exist, it is recommended that varieties be submitted for review to determine their merit for certification.

A. Acceptance of varieties for certification shall be based on the following :

1. A statement and supporting evidence by the originator, developer or owner requesting certification that the variety has been adequately tested to determine its value and probably area of adaptation, and that it merits certification, and that it is distinguishable from other varieties, as set forth in Article 5, International Code of Nomenclature for Cultivated Plants, which reads as follows :

> "The term cultivar (variety) denotes an assemblage of cultivated individuals which are distinguished by any characters (morphological, physiological, cytological, chemical or others) significant for the purposes of agriculture, forestry or horticulture , and which, when reproduced (sexually or asexually) retain their distinguishing features."

2. A statement on origin and breeding procedure.

3. A description of the morphological characteristics (such as colour, height, uniformity, leaf, head or flower characteristics, etc.), physiological characteristics disease and insect reactions, and any other identifying characteristics of value to field inspectors, and such other factors as the breeder or sponsor considers pertinent.

4. Evidence on performance, including data on yield, insect or disease resistance and other factors supporting the value of the variety. These performance tests may be conducted by private seed firms or Agricultural Experiment Stations, and shall include appropriate check varieties which are used extensively in the area of intended usage.

5. A statement giving suggested regions of probable adaptation and purposes for which the variety will be used. This should include States or Provinces where the breeder of the variety has tested it and anticipates recommending and merchandising.

6. Procedure for maintenance of stock seed classes shall be described. At the time a variety is accepted for certification, a sample lot of breeder seed shall be presented to the certifying agency. This is to be retained as a control varietal sample against which all future seed stocks released for certified seed production may be tested to establish continued trueness of variety.

APPENDIX—X

FERTILISER CREDIT GUARANTEE CORPORATION

Incorporation :

The Corporation may be set up as a company under the Companies Act, 1956, with a paid up capital of Rs 25 million and an authorized capital of Rs 50 million. Two of the share-holders may be the Government of India and the Reserve Bank of India, the latter holding the majority of the shares. In order to enable the Reserve Bank to take up the shares, it will be necessary for the Central Government to issue a notification under Section 17(8A) of the Reserve Bank of India Act declaring the new company to be a financial institution for this purpose.

Objects :

The Corporation will operate a scheme to be known as the Fertilizer Credit Guarantee Scheme. In general terms, the objects of the Corporation will be :

(i) to ensure availability of larger bank credit for the stocking and distribution of fertilizer, pesticide and other items [*see* 3 (iii) below] by extending to banks and other credit institutions :

(a) guarantees against advances made ; or

(b) counter-guarantees against guarantees or acceptances given ;

by banks to stockists, distributors, wholesalers, sub-wholesalers and retailers ; and

(ii) to supplement in other ways the credit available for fertilizer, pesticide and other approved items.

In connection with object (ii), an eventual possibility could be that of the Corporation assuming re-financing functions *vis-a-vis* banks and other credit institutions in so far as loans for fertilizer, pesticide and other approved items are concerned. We do not, however, pursue the point here beyond suggesting that the Reserve Bank examine it in due course.

Items covered :

(i) manufactured chemical fertilizers ;

(ii) agricultural pesticides and portable equipment for the application thereof ; and

(iii) such other item of importance for agriculture as may be approved from time to time by the Reserve Bank of India.

Distribution agencies covered :

(i) Manufacturers (or importers) of fertilizer, pesticide, or other approved items who take to distribution on their own or supply, on credit, to distribution agencies in the co-operative, private or public sectors ;

(ii) Distributors, whether (a) joint stock companies, partnerships or individuals or (b) wholesalers, sub-wholesalers or retailers ;

(iii) Co-operative distribution agencies at the State, district, taluka, village or other levels ; and

(iv) such other distribution agencies as the Guarantee Corporation may approve from time to time.

Eligible Credit Institutions :

(i) (a) all scheduled commerial banks, including the State Bank of India and its subsidiaries ;

(b) such non-scheduled banks as may be approved from time to time by the Reserve Bank of India ;

(ii) (a) all State Co-operative Banks;

(b) such Central co-operative banks as may be approved from time to time by the Reserve Bank of India ; and

(iii) such other credit institutions as may be approved from time to time by the Reserve Bank of India.

Parties and Transactions covered by the Guarantees and Counter-Guarantees :

The parties to the transactions may be any of the distribution agencies mentioned in item 4 above, either private or co-operative, and at any of the levels mentioned, viz., distributor, wholesaler, sub-wholesaler or retailer. Subject to this, the types of transactions covered would be as indicated below:—

(i) Transactions covered by guarantees :

Advances of banks or credit institutions against :

(a) hypothecated or pledged stocks ; or

(b) book-debts or bills discounted, representing supply, on credit, of fertilizer, pesticide or other approved item.

(ii) Transactions covered by counter-guarantees :

Guarantees or acceptances extended by banks or credit institutions on behalf of their clients in respect of supplies of fertilizer, pesticide or other approved items made to the clients by the suppliers.

We consider (ii) above to be particularly important from the point of view of retailers, whether private or co-operative. If these can obtain suitable guarantees from their banks (in order that adequate credit/consignment supplies may be made to them by the wholesaler) the banks in turn can cover part of their risk with the Guarantee Corporation.

Margins to be maintained.

Since the object of the scheme is to liberalize bank finance in consideration of adequate guarantees and counter-guarantees, it is necessary that the Corporation should stipulate that the margins maintained by the banks should not be above a prescribed maximum. The maxima should, in our view, be as follows :—

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	Maximum Margin
(i) Advances against stocks :	
(a) pledge	5 per cent
(b) hypothecation	10 per cent
(ii) Advances against book-debts or bills discounted :	
(a) where the bills have been accepted by a bank	5 per cent
(b) where they have not been accepted	20 per cent
(iii) In all other cases	As prescribed by the Guarantee Corporation

Period of credit :

For purposes of the Guarantee Scheme, we consider that the period of credit should not exceed six months (whether against stocks, book debts or bills discounted). We believe that this period is long enough to enable a retailer, in appropriate cases, to give temporary accommodation of reasonable duration to the farmer to whom he has supplied fertilizer. We have elsewhere recommended that the Reserve Bank of India Act be so amended as to place bills arising from the fertilizer trade on the same footing as those connected with export of goods from India for purposes of refinance from the Reserve Bank of India, i. e., be eligible for a maturity of 180 days instead of the normal 90 days.

Extent of Guarantee :

The Guarantee Scheme should provide for the credit institutions invoking the protection of the Guarantee Corporation within a stipulated period, say, within one month of the date of default. The extent of the guarantee cover provided by the Corporation should be decided on the merits of each case, but should in no case exceed 65 per cent of the amount in default. On the guarantee being validly invoked, the Corporation should make good the agreed proportion of the amount in default, the remainder being borne by the credit institution concerned. The recoveries made after the payment of the claim should be shared between the Corporation and the bank in the same proportion. The detailed scheme may spell out the respective rights of the Guarantee Corporation and the credit institution in this regard.

Premium :

It is difficult, at this stage, to assess the magnitude of the risks involved from the point of view of the banks, but there is no reason to think either that these will be very great or that they cannot be substantially reduced as the banks gain experience. To some extent, the risk will vary from party to party and transaction to transaction. A scale can be laid down in the light of experience. The Corporation will conduct its operations on commercial principles, but this will be subject to its main aim of bringing about a liberalization of bank finance for fertilizer stocking and distribution. In broad terms, we consider that the rate of premium to be paid on the guarantee or counter-guarantee may vary from ½ per cent per annum to 2½ per cent per annum, depending on the assessment by the Guarantee Corporation of the degree of risk involved in different transactions, either individually or by categories.

Funds :

The initial paid-up share capital of Rs 25 million would yield income on its investment which should, in our opinion, be adequate to cover the expenses of the Coproration on its management and administration. Besides this, we consider that a sum of Rs 100 million should constitute adequate initial resources for the Corporation. We accordingly recommend that the Government of India may extend to the Corporation a loan of Rs 100 million on the basis of either no interest at all or a nominal interest, so as to constitute the corpus of a Guarantee Fund. Further, the Government should be prepared to convert a portion of the loan into a grant in due course, if so required depending on the magnitude of the liabilities which may arise from the operations of the Corporation as guarantor. To augment its resources, the Corporation may be empowered to float bonds guaranteed by the Government on such terms as the Government considers appropriate.

Other matters :

It is obvious that the Reserve Bank of India is intimately concerned with all the functions of the proposed Corporation. Indeed, without active co-ordination with the machinery of the Reserve Bank, it would hardly be possible for the Guarantee Corporation to operate effectively. We recommend, therefore, that the Fertiliser Credit Guarantee Corporation should be located and administered in such a way that it remains closely associated with the Reserve Bank of India.

APPENDIX—XI

Paper which attends breeder seed of new varieties and new elites from the Swedish Seed Association :

1. Crop—

Cultivar name ..

Registration number ..

New cultivar, origin ..

New elite ..

Field number of the yield ..

Amount of seed, kgs. ..

2. The notation of elite at the Division of Seed Control (Swedish Seed Association)

3. Approval of delivering by the breeder

4. Results from the analysis done at the Division of Seed Control ..

Admixtures :

Seeds of harmful crops ..
Seeds of other crops ..
Weed seeds ..
Kernel character : ..

5. Sealed at the storehouse of the Swedish Seed Association

6. Order of the Director about delivering to the Seed Company ..

7. Certificate that the seed is delivered ..

8. Acknowledgement from the Seed Company that the seed has been obtained in sealed condition ..

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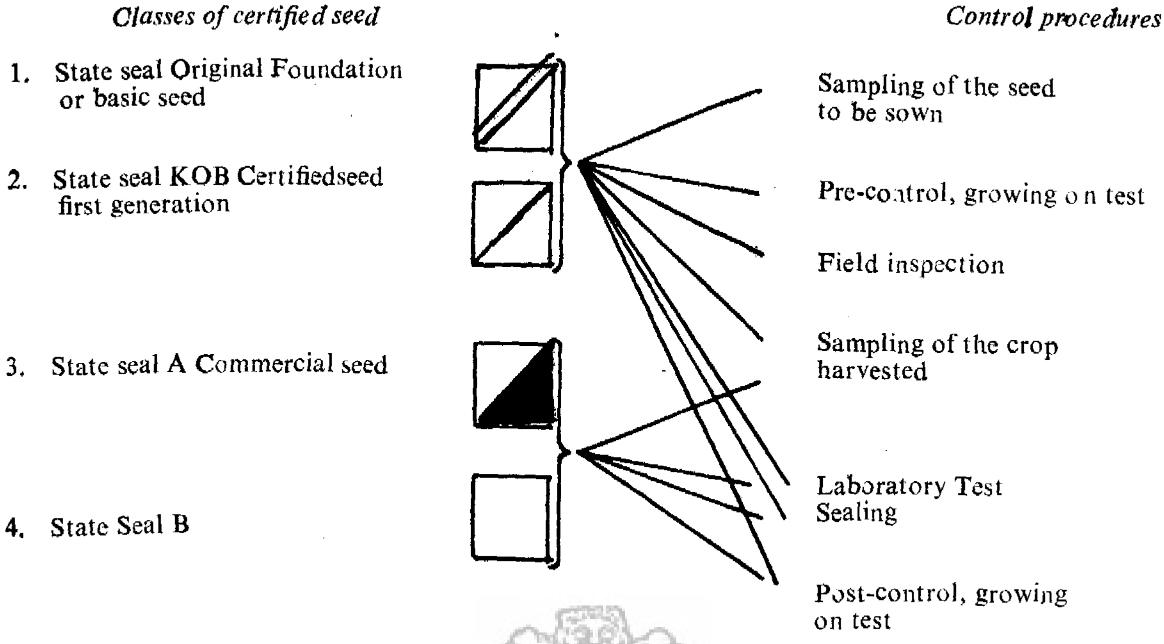
APPENDIX—XII

Scheme and standards for control of trueness to variety in the Swedish State Seed Certification :


Classes of certified seed
1. State seal Original Foundation or basic seed
2. State seal KOB Certifiedseed first generation
3. State seal A Commercial seed
4. State Seal B
Control procedures
Sampling of the seed to be sown
Pre-control, growing on test
Field inspection
Sampling of the crop harvested
Laboratory Test
Sealing
Post-control, growing on test

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After July 1st, 1962, for close-pollinators and after July 1st, 1963, for open polinators the seed to be certified as state seal A and state seal B must be based upon seed of verified class. For open-pollinators the generations are limited to one in every certification-class except for state seal KOB, where two are allowed. For close-pollinators the generations of each class except for state seal B are depending upon the results of the trueness to variety test. State seal B is limited to one generation.

Standards for purity of variety :

	Classes of certified seed			
	State seal original	State seal KOB	State seal A	State seal B
Pre-control—				
Other varieties	0,10	0,10	..	..
Aberrants	0,10	0,10	..	..
Total	0,10	..	..	..
Post-control—				
Other varieties	0,10	0,20	2	3(×)
Aberrants	0,10	0,10	..	..

(×) Highly deviating varieties.

APPENDIX—XIII

CULTIVATION AND CONTROL OF SEED POTATOES

Control of seed potatoes :

Potatoes take a special place among cultivated plants, and the quality standards for seed potatoes partly deal with quite different properties than those of other plants. The factors determining the value of potatoes for seed are purity of variety, freedom from diseases and size of tubers. The control must include both fields inspections and control of the crop harvested, since virus diseases are the most dangerous among potato diseases and cannot be diagnosed by symptoms of the tubers. Further a positive determination of varietal purity cannot be made without observations on growing plants.

From July 1st, 1962, Sweden has a "Seed Act" concerning potatoes similar to that dealing with cereals and other seeds. All seed potatoes, which are publicly sold, have to be controlled by the Central Seed Testing Station. This control includes the basic seed, which must be certified at least one field inspection and at an inspection of the crop harvested. This tuber inspection can be done by the grower himself. At the time of selling there must be statements concerning the name of the seller, the variety, the field inspection number, the size of tubers, the quality at field inspection and the quality of tubers.

Besides these minimum requirements for seed potatoes there exists a voluntary system of control and a Government sealing for potatoes. This system includes four quality classes, namely, State Seal Test, E, A and B. Only varieties entered in the variety list of the Board of Original Seed ("Original-utsadesnamnden") can be certified. A potato crop cannot be approved for seed, if the farm, where it is grown, should be infected by wart disease or ring-rot. The field must be free from potato root eelworm, which is determined by taking soil samples. Seed potato growing is only allowed in fields, where there have been no potato grown during the two previous years. At most three different varieties may be grown at the same farm. The plantation must be situated at least 25 metres from any other potatofield and from green house.

The crop must be based on government sealed seed potatoes of the classes Test, E or A or the farmer's own seed potatoes, which have been approved the year before for Government sealing. The growing crop is inspected at least twice at different stages of development. If considered necessary for variety-determination or disease/diagnosis, samples from the original seed potatoes may be taken for control cultivation at the experimental fields of the Seed Testing Station.

For classifying the growing crop a calculation is used based on defect units ; every percentage admixture of any other potato variety (rogues), of any plants affected by diseases, or of any diverging types are multiplied with a co-efficient, which is different in relation to the defect (see below). The result is called defect units and are added to a sum, which is the total defect units for the growing.

Kind of defect		*Co-efficient*
Rogues	..	18
Severe virus diseases	..	6
Wildings	..	6
Bolters	..	2
Black leg	..	1/½

In the case of State Seal Test the original seed tubers are investigated as to freedom from virus diseases by green-house testing using potato juice transferred to indicator plants or by serological methods. The healthy tubers are then propagated as clonal selections for at least three years. Most of this material is grown in districts in the north of Sweden with a low virus spread or very well isolated from other potato fields in districts of very high altitude and surrounded by forests.

Before sealing as certified seed the potato lot is sorted according to size and tuber defects and then inspected by personnel working for the Central Seed Testing Station. The allowed sizes are 30—40 mm, 40—50 mm and 50—55 mm. For export purposes or if a special agreement is made between seller and buyer, other assortments may be used.

For defects on tubers the system of defect units is also practised and the following co-efficients are used :—

Kind of defect	*Co-efficient*
Watery rot and bad injuries by frost ..	9
Blight, Fusarium rot and other dry rot ..	3
Dried, faint injuries by frost or heat, black scarf (Rhizoctonia), skin spot (Oospora), corky ring spot ..	1
Powdery scab (Spongospora), mechanical injuries ..	1 ½
Common scab, cracks, bad deformities, deviating size ..	1/4

Practical seed potato production :

In most parts of Sweden there are favourable conditions for production of virus-free potatoes. In the northern parts of the country virus spreading aphids are very rare. Further more, the cultivated area of Sweden is often divided by forests, and even single farms are often cut up by wooded areas hindering aphids to pass from one potato field to another. Virus diseases are widely spread only on the plains of the southern most province, especially in the Southwest. Nacrotic strains of virusly (vential necrosis) have never been found in Swedish seed potatoes. Practically all State sealed seed potatoes originate from virus tested material and most of the varieties are free from viruses X and S or have a very low percentage of these viruses.

The control of wart disease is directed by law, removal of potatoes and similar products is forbidden, not only from infected farms but also from places within spacious "Protective areas" surrounding them. In these "protective areas" only wart immune varieties must be grown.

In order to avoid spreading of virus, seed potato growing is mostly located to the northern parts of the country and the inners wooded areas of middle and southern Sweden. Seed pototes tested in greenhouses are mainly multiplied in the northernmost provinces.

Scheme over requirements for seed potatoes

Class	Stock seed	Number of generations	Isolation	Maximum total defect units		
				Field Inspection		Tuber Inspection
				1		2
State Seal Test	Test or approved material	8	100 m. (×)	3	0	6
State Seal E	Test or E1	2 1	25 m.	4	2	6
State Seal A	Higher Class, A or own B	(× ×)	25 m.	8	4	6
State Seal B	Higher	(× ×)	25 m.	12	6	6
Minimum requirements for seed potatoes	State seal	1	10 m.	..	16	12

(×) Special regulations in some district.
(× ×) Unlimited, according to the results of field inspection.

for production of seed potatoes classified as Test. The main part of seed potatoes of classes E, A and B is produced further south based on Test potatoes from North Sweden. A farmer using Test potatoes brought from another farmer may get his crop classified as E for two years, if it is approved for that class at field inspection. All cultivaton of seed potatoes for Government sealing must be based on Government sealed potatoes of classer Test, E or A or on the farmer's own potatoes previously approved. In practice, it is rather common nowadays that new cultivations for production of class A seed potatoes begin with class Test or E. This is a very good tendency. Seed potatoes of class B are not suited for production of seed. This class represents a seed quality suitable for production of potatoes for food, fodder, and industrial purposes.

In Sweden seed potatoes are grown either on contracts with large concerns or on a "free-lance" basis. Among concerns signing contracts with farmers should be mentioned the Svenska Lantmanners Riksforbund (The Swedish Farmers' Purchasing and Selling Association) together with its affiliatted Central Foreningar (Districts Societies) and the Rederi AB Nordsjornan. (The Nordstenan Shipping Company). The latter owns an institute for agricultural research, called I.V.K. (Institue for Plant Research and Cold Storage, Nynashamn), especially working on the production of virus free seed potatoes by individual testing of original material. Multiplying of this is made partly at a farm owned by the company, partly on contracts in northern Sweden at farms with favourable conditions for the production of a healthy crop.

Fields entered for control must be rogued according to directions ordered by the inspector at the first inspection of the growing crop. Roguing includes the sorting out of extraneous varieties and plants infected by virus or other diseases. In the case of extraneous varities the tubers must be taken away from the field and in the case of virus diseases the whole plant must be removed to a place at least 50 meters from the field.

Potato blight must be controlled as effectively as possible; top killing is recommended as a means of preventing attacks of the tubers. Top killing has many other advantages, and its popularity is increasing.

For planting and harvesting more or less automatic implements are used to a great extents.

Seed potatoes should be carefully handled during cropping, transporting and storing ; and they should be guarded from damages by frost, heat and dampness.

At the harvest all admixing must be prevented. Storing pits may not be placed where other varieties of potatoes, uncontrolled potatoes or potatoes from a rejected crop have been stored in any of the four preceding years. Storage houses and equipment have to be cleaned and disinfected and approved seed potato lots may not be stored in the same locality of other potato lots.

The size of fields entered for Government sealing vary very much in Sweden from about 0.5 hectare up to about 10 hectares.

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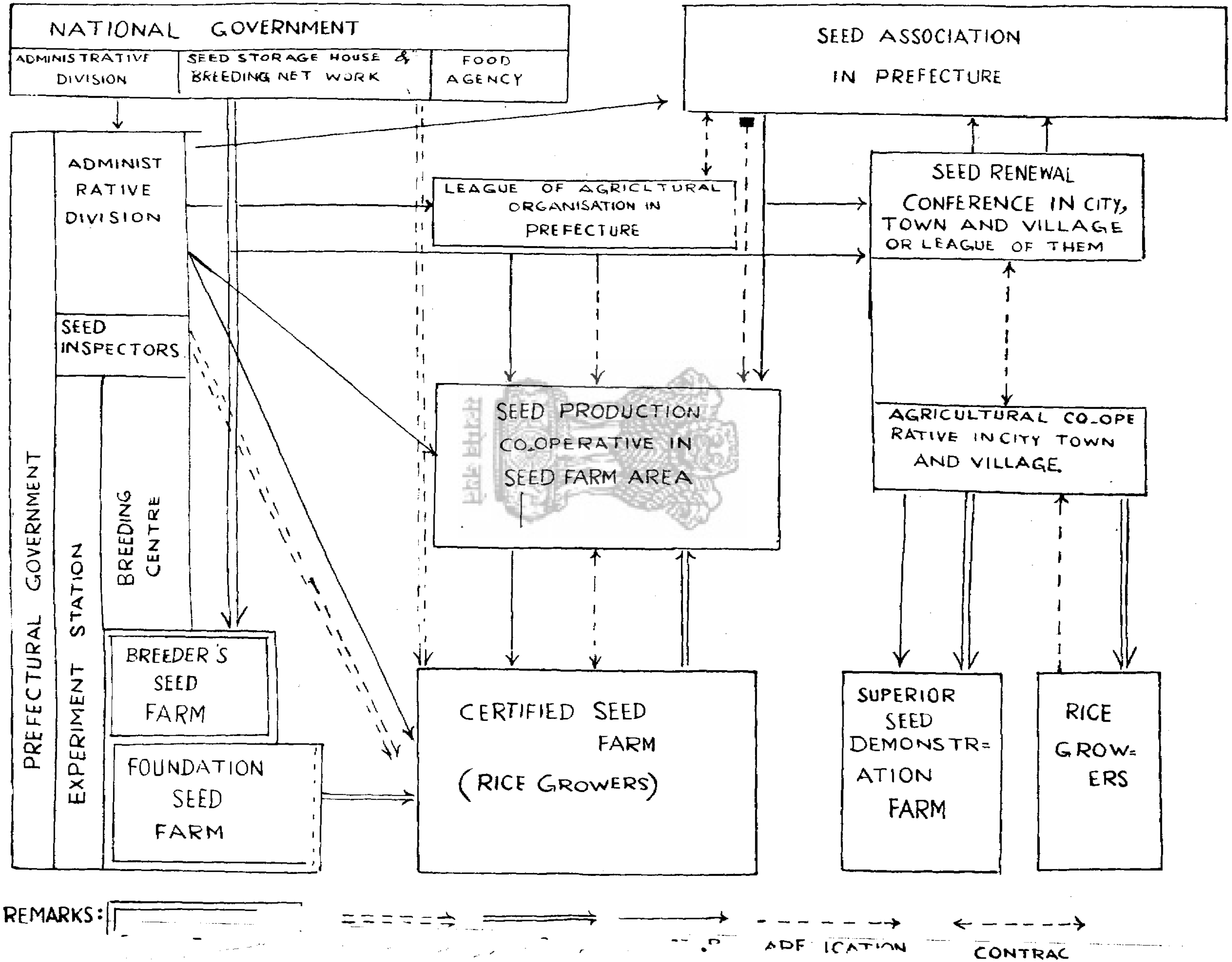
Since small fields as a rule are treated with greater care and attention, seed potatoes from them are often purer and healthier than those from large fields. The total acreage entered for field inspection is increasing and in 1962 was about 2750 ha.

APPENDIX : LXIV

DIAGRAMATIC SCHEME FOR SEED PRODUCTION, CERTIFICATION AND DISTRIBUTION SYSTEM IN JAPAN (1966)


NATIONAL GOVERNMENT
ADMINISTRATIVE DIVISION
SEED STORAGE HOUSE & BREEDING NET WORK
FOOD AGENCY
SEED ASSOCIATION IN PREFECTURE
ADMINISTRATIVE DIVISION
SEED INSPECTORS
LEAGUE OF AGRICULTURAL ORGANISATION IN PREFECTURE
SEED RENEWAL CONFERENCE IN CITY, TOWN AND VILLAGE OR LEAGUE OF THEM
PREFECTURAL GOVERNMENT
EXPERIMENT STATION
BREEDING CENTRE
SEED PRODUCTION CO-OPERATIVE IN SEED FARM AREA
AGRICULTURAL CO-OPERATIVE IN CITY TOWN AND VILLAGE
BREEDER'S SEED FARM
FOUNDATION SEED FARM
CERTIFIED SEED FARM (RICE GROWERS)
SUPERIOR SEED DEMONSTRATION FARM
RICE GROWERS
REMARKS:
APPLICATION
CONTRAC

APPENDIX—XV

THE SEED STORAGE HOUSE FOR GENETIC STOCKS

National Institute of Agricultural, Sciences (Hiratsuka) Hiratsuka, Kanagawa, Japan

The seed storage house was completed in March, 1966, and the seed storage service has started at the centre of seed storage and exhange in Japan. The seeds stored in this house are limited to germ plasms for plant breeding use. It concerns not only agricultural crop plants but also horticultural, industrial and forage crop plants. The size of this storage house is 336 sq. meters in all. The cost of building and air-conditioning facilities amounts to 41,085,000 or US $ 114.125.

No.	Room	Space	Air Condition		Remarks
			Temp.	R.H.	
		Sq. M.	C.	%	
1.	Entrance ..	9·38	..	..	
2.	Control room ..	39·00	20—30	..	
3.	Seed cleaning room ..	10·00	..	..	
4.	Operation room ..	39·36	20—30	30	Seed driver sealer vaccum
5.	Entrance to storage rooms	6·00	..	..	
6.	Long term storage room	63·00	– 1	30	
7.	Extremely long term storage room	34·50	– 10	30	
8.	Machine room for rooms No. 4—7 ..	91·00	..	..	Air condition
9.	Germination test room No. 1 ..	10·00	—20		2,000 Lux ill
	Germination test room No. 2 ..	10·00	Variable	..	2,000 Lux nat
	Machine room for rooms No. 9—10 ..	15·00	..	..	Air-condition
	Spare room ..	5·00	..	..	
	Laboratory ..	3·75	..	..	
	Total ..	335·99			

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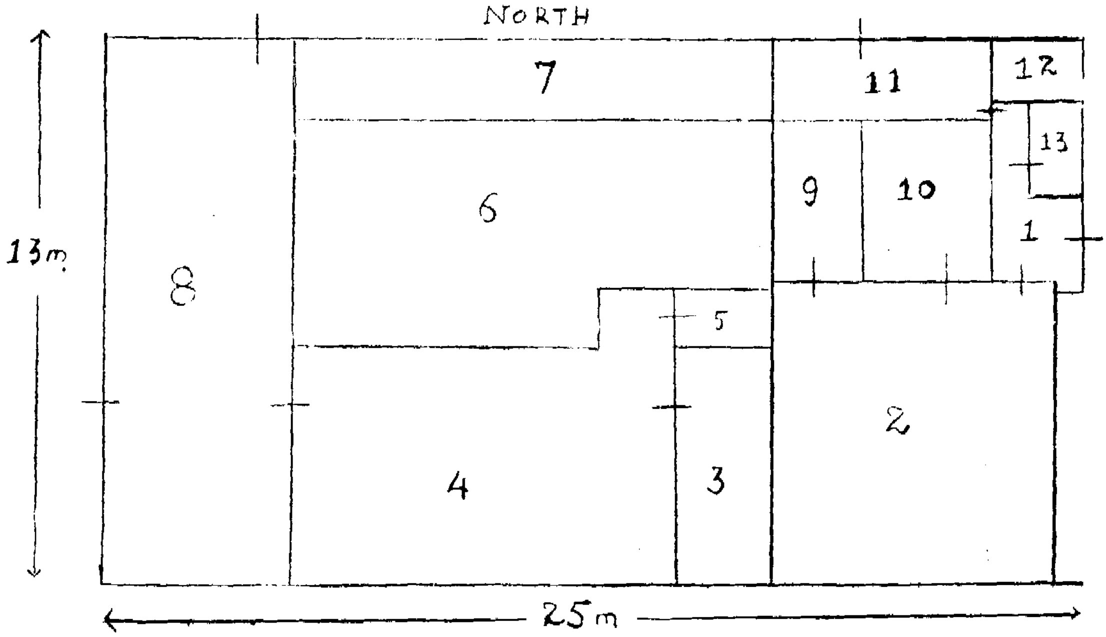
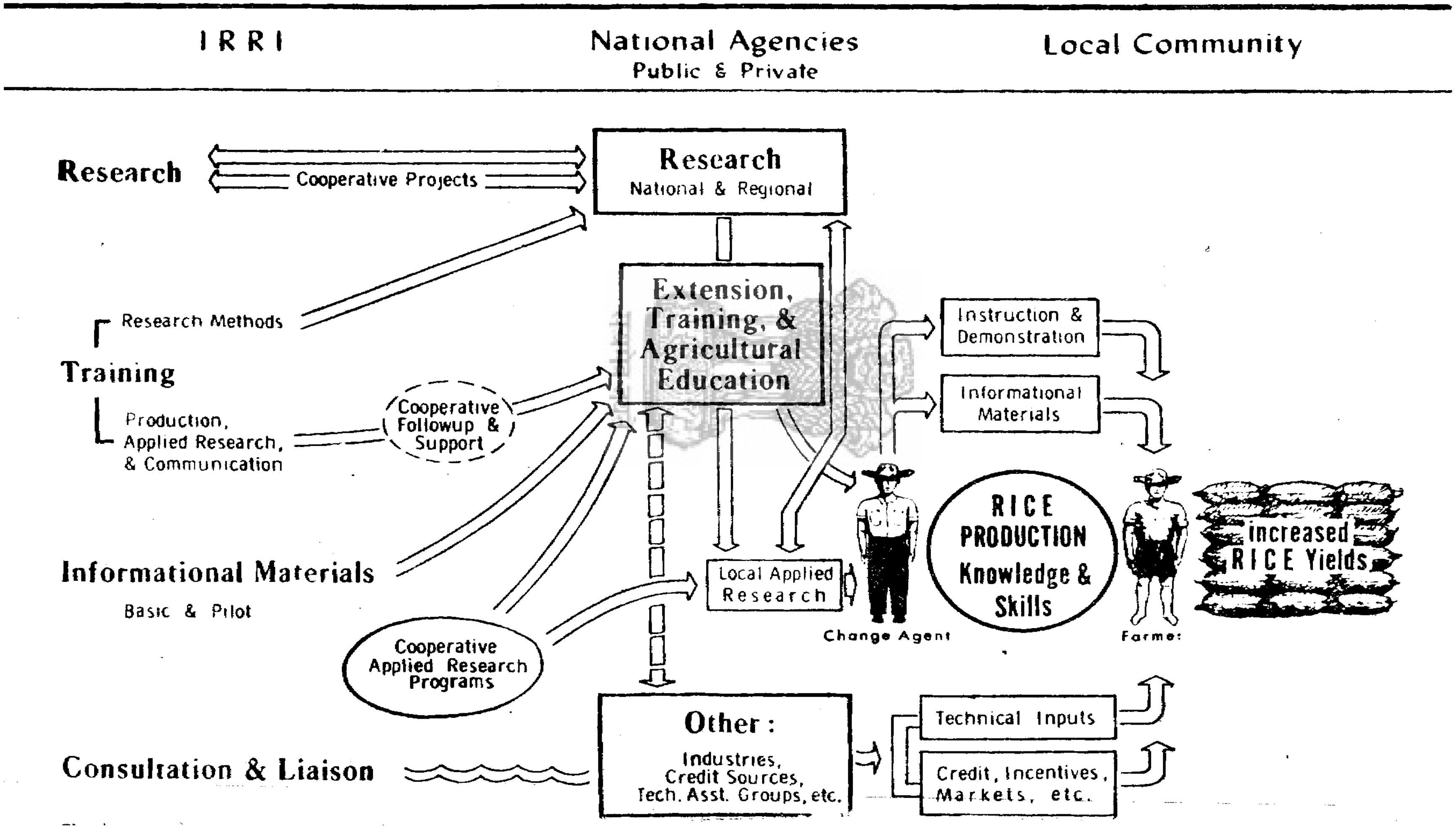


Appendix—XVI

Activities to Increase Rice Yields


IRRI
National Agencies
Public & Private
Local Community
Research
Cooperative Projects
Research
National & Regional
Research Methods
Training
Production, Applied Research, & Communication
Cooperative Followup & Support
Extension, Training, & Agricultural Education
Instruction & Demonstration
Informational Materials
Informational Materials
Basic & Pilot
Cooperative Applied Research Programs
Local Applied Research
Change Agent
RICE PRODUCTION Knowledge & Skills
Farmer
Increased RICE Yields
Consultation & Liaison
Other:
Industries, Credit Sources, Tech. Asst. Groups, etc.
Technical Inputs
Credit, Incentives, Markets, etc.

APPENDIX—XVII

DEFINITIONS OF TERMS USED FOR THE PURPOSES OF THE O.E.C.D. HERBAGE SEED SCHEME

Designated Authorities :

Authorities designated by and responsible to the Government of a participating country for the purposes of implementing these Rules and Directions on its behalf.

Basic Seed :

Bred Cultivators.—The seed has been produced under the responsibility of a breeder according to the generally accepted practices for the maintenance of the cultivator and is intended for the production of certified seed. It must conform to the appropriate conditions in the O.E.C.D. Herbage Seed Scheme and the fulfilment of these conditions must be confirmed by an official examination.

Local Cultivars—The seed has been produced under official supervision from material officially admitted for the purpose of local cultivation on one or more farms situated in an adequately defined region of origin and is intended for the production of certified seed. It must conform to the appropriate conditions in the O.E.C.D. Herbage Seed Scheme and the fulfilment of these conditions must be confirmed by an official examination.

Certified seed :

The seed is of direct descent from either Basic Seed or Certified Seed of a cultivar and is intended for the production of either Certified Seed or of fodders. It must conform to the appropriate conditions in the O.E.C.D. Herbage Seed Scheme and the fulfilment of these conditions has to be confirmed by an official examination.

The first generation from Basic Seed is known as :

Certified Seed, 1st Generation ;

Further generations are known as :

Certified seed, 2nd Generation, etc., the appropriate generation being designated.

Cultivar :

As defined in the International Code of Nomenclature for Cultivated Plants : "The term cultivar abbreviated cvr denotes an assemblage of cultivated individuals which are distinguished by any characters (morphological, physiological, cytological, chemical or others) significant for the purposes of agriculture, forestry, or horticulture, and which, when reproduced (sexually or asexually), retains their distinguishing features". (International Code of Nomenclature for Cultivated Plants 1961 formulated and Adopted by the International Commission for the Nomenclature of Cultivated Plants of the International Union of Biological Scienes, Article 5).

Bred Cultivar :

A cultivar which has been produced by a plant breeder as the result of breeding.

Plant Breeder or Breeder :

The person or organisation responsible for the production and or maintenance of a Bred cultivar included in a national list of cultivar eligible for the O.E.C.D. Herbage seed scheme.

Local Cultivar :

A cultivar from a defined region of origin which has been shown by official tests to have sufficient uniformity, stability and distinctness to warrant recognistion but has not been produced as a result of breeding work.

Region of Origin for a local Cultivar

A distinct farming area which is uniform in respect of climatic conditions and in which similar agricultural practices are followed. The boundaries of this area must be defined.

APPENDIX —XVIII

SPECIMEN CERTIFICATES AND ANALYSIS RESULTS

A Specimen Certificates

Certificates must contain all the information outlined below, but the exact arrangement of the text is at the discretion of the Designated Authority)

Certificate issued under the O.E.C.D. Scheme for the varietal Certification of Herbage Seed Moving in International Trade

Basic Seed

Name of Designated Authority issuing the Certificate

Reference No. ..

Species ..

Cultivar ..

Number of containers and declared weight of lot

The seed lot bearing this reference number has been produced in accordance with the O.E.C. Herbage Seed Scheme and is approved as :—

Basic Deed (white label)

Signature

Place and Date

Certificate issued under the O.E.C.D.Scheme for the varietal Certification of Herbage Seed Moving in International Trade

Certified Seed

Name and Designated Authority issuing the Certificate ..

Reference No. ..

Species ..

Cultivar ..

Number of containers and declared weight of lot

The seed lot bearing this reference number has been produced in accordance with the O.E.C.] Herbage Seed Scheme and is approved as :

*Certified Seed, 1st Generation (blue label).

**Certified Seed (red label)

Signature

Place and date

*Delete as necessary.

**Inset number of generation.

B Analysis Results

The result of the laboratory analyses should, whenever possible, be given on the Orange International Seed Lot Certificates issued under the authority of ISTA.

Those countries which do not use the "Orange Certificate" as issued by the Association may use it as a model for reporting the results of laboratory analyses as required in the Rules and Directions of the O.E.C.D. Herbage Seed Scheme. Specimen copies may be obtained from:—

The Secretariat,
International Seed Testing Association,
Binnenhaven 1,
WAGENINGEN,
The Netherlands.

The actual "Orange Certificate" issued by ISTA must be used only by those countries which have authority to do so from the Association. Other countries using this certificate as a model for the pre- ation of results must ensure that there is no implication that they are issuing an "Orange Certificate". instances, reference to ISTA must not be made, and the Certificate should not be on orange paper.

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APPENDIX —XIX

SPECIFICATIONS FOR THE O.E.C.D. LABEL

1 Shape

The label shall be rectangular (1.75x1) with square corners.

2 Colour

Colours on both sides shall be as close as possible to the red, white and blue labels originally printed by the O.E.F.C. One end shall be over-printed black for a minimum distance of 5 cm, leaving the rest of the label coloured.

3 Reference to the O.E.C.D. Scheme :

The name of the O.E.C.D. Scheme shall be printed within the black portion on each side of the label. This name shall read on one side "O.E.C.D.Herbage Seed Scheme", and on the other side "System del'O.E.C.D.pour les semences Fourrages". These words shall be printed with a minimum height of lettering of 2 mm.

4 Space and Lettering, one side of Label :

To be printed in black type on the coloured portion of the card (white blue or red, as the case may be)

Information to be given	*Minimum height of space to be allowed*	*Minimum height of lettering to be used*
Species (Latin name)	9mm	3mm
Cultivar name	9 mm	3 mm
Category	9 mm	3 mm
Reference Number	9 mm	3 mm
Region of production (if required)	9 mm	3 mm

Any space not occupied by the above may be left blank or used for such additional inforn as the Designated Authority wishes to give. Such information, however, must be in letters not large those used for the prescribed information.

5 Space and lettering, Reverse side of Label :

To be printed in black type on the coloured portion of the card (white, blue or red, as the case may

Information to be given	*Minimum of space to be allowed*	*Minimum heigh of lettering to be*
Name and address of Designated Authority	20 mm	2.5 mm
Statement of re-labelling (if required)	20 mm	2 mm

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The statement shall be made in the following words .

"Country of production......................................

Original reference number ...."

Any space not occupied by the above may be left blank or used for such additional information as the Designated Authority wishes to give. Such information, however, must be in letters not larger .. ... those used for the prescribed information, except for label numbers.

6 Additional Information :

Any information added by the Designated Authority shall be strictly factual and relate only to t seed certified according to the O.E.C.D. Herbage Seed Scheme. No advertising matter may be used the label.

7 Languages :

All the information printed on the card shall be given in either English or French except for the na of the scheme, which must be in both English and French as specified in paragraph 3 above. Translati into any other language may be added if thought desirable.

8 Sample Label :

A sample of any label to be printed nationally must always be submitted to the O.E.C.D. or pri approval.

8398/G of 1-1,500-4-12-68 Govt. Press Chd.